North Central Texas Council of Governments

Project Update Meeting

Transportation and Stormwater Infrastructure Study

September 2024

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.

Welcome!

Speaker introductions

Please take the pre-meeting survey

Paper/pen version available

Study Background

www.nctcog.org/tsi

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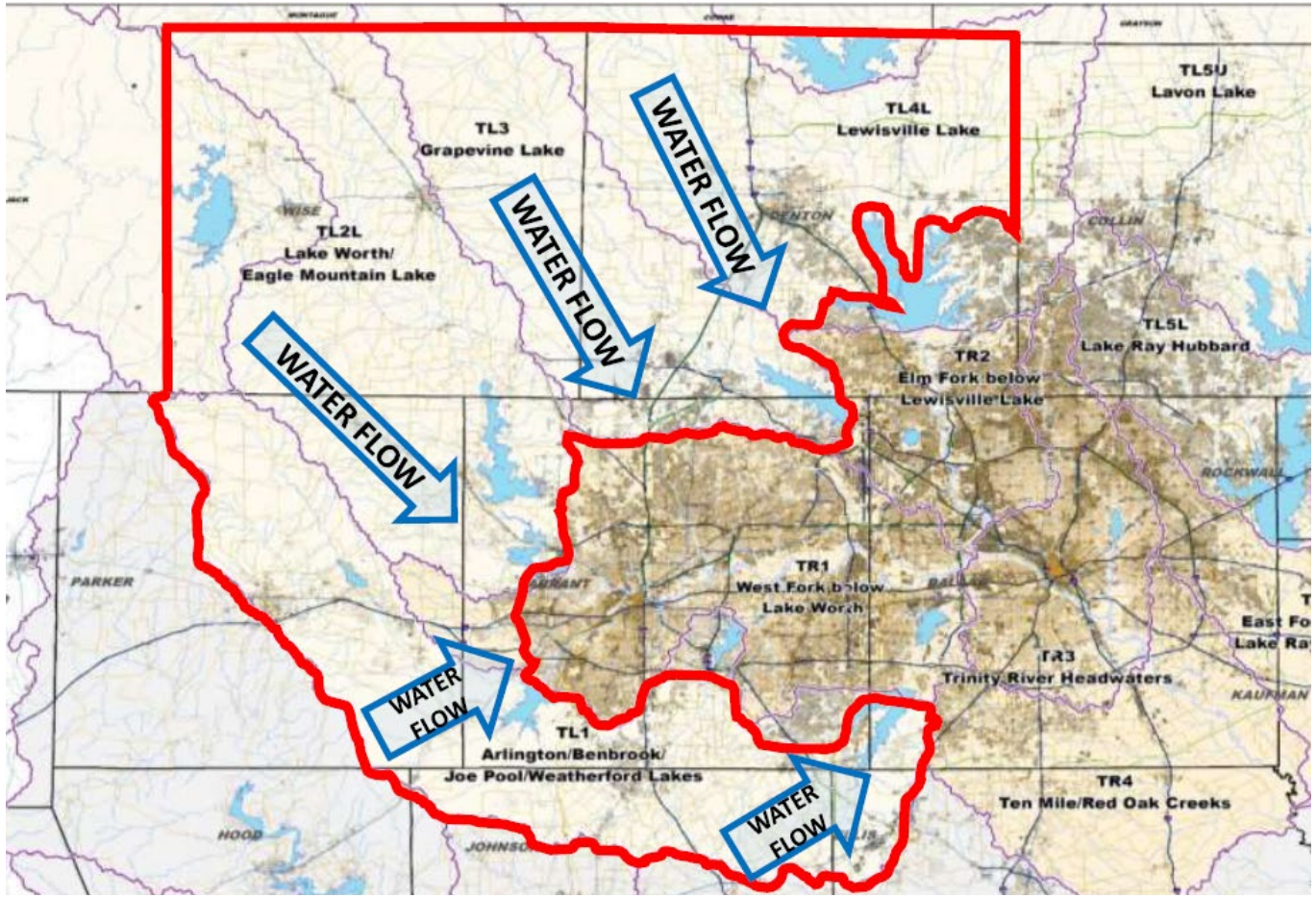
Integrated Transportation and Stormwater Infrastructure (TSI) Initiative

- Integrate stormwater management, urban development, transportation, and environmental planning
- Identify impacts and alleviate risks from flooding
- Get ahead of growth
- Reduce costs



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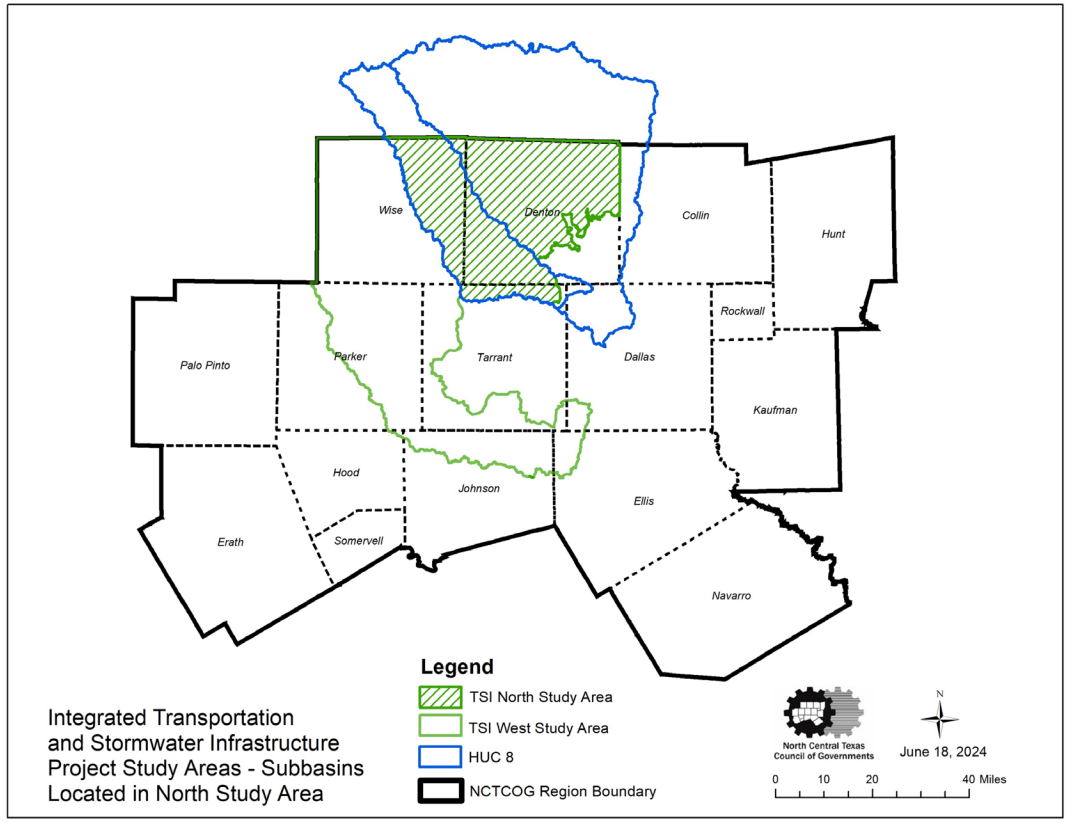
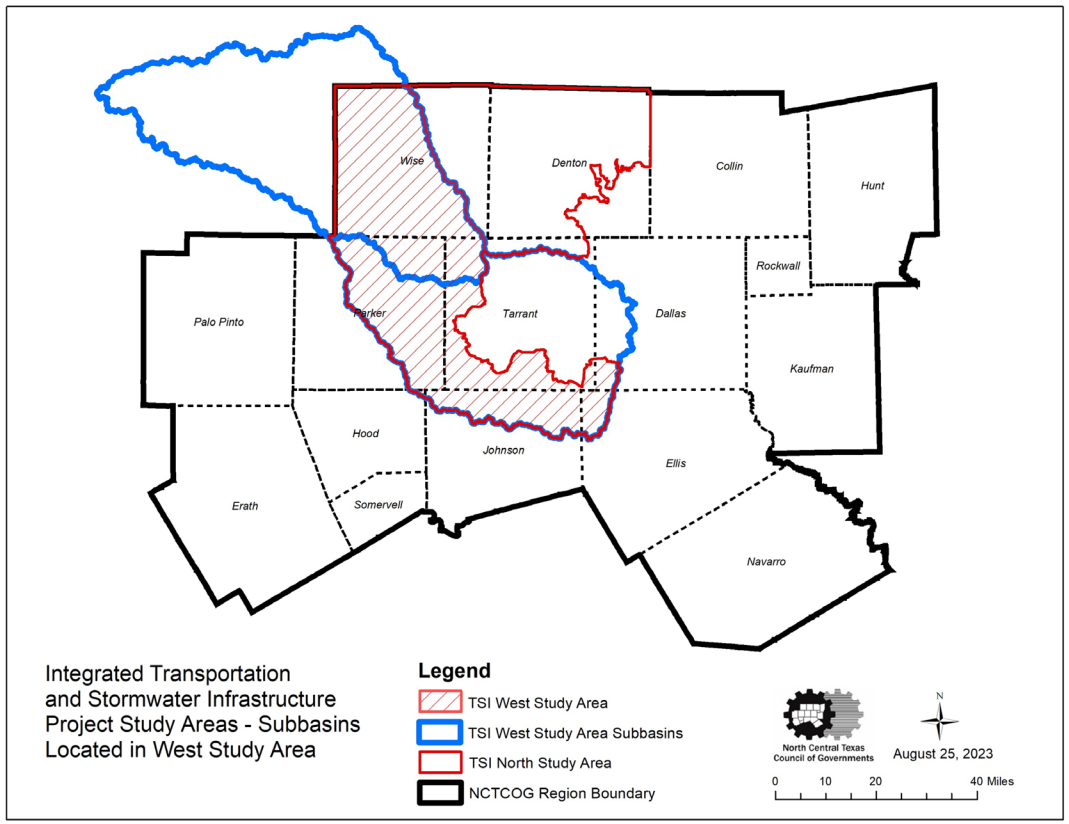
North and West Study Areas





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

Ongoing Challenges

Urbanization Demands

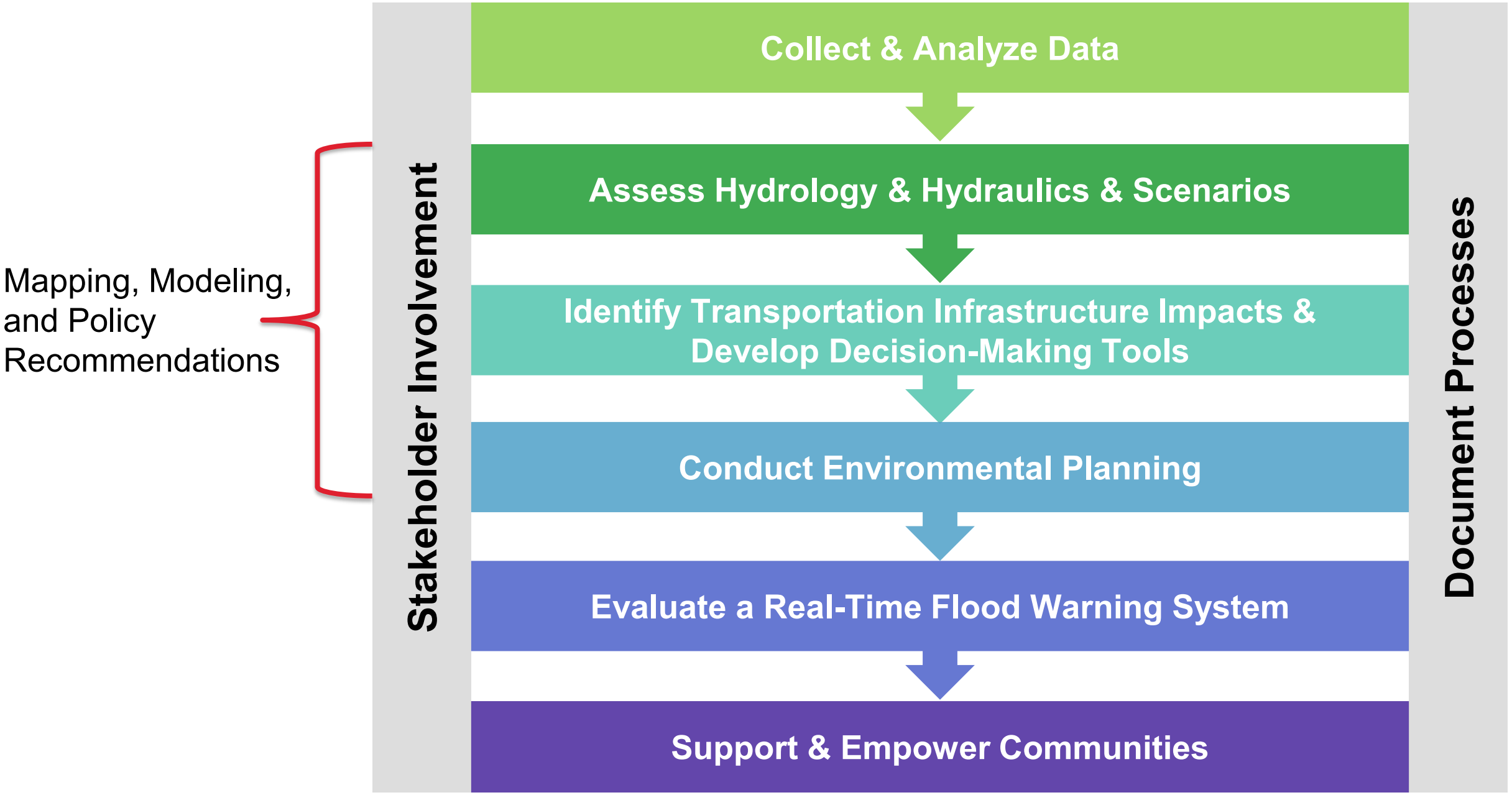
- About 50,000 people are moving to the study area every year
- More urbanization and development leads to more impervious surfaces

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



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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 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

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Data & H&H Modeling

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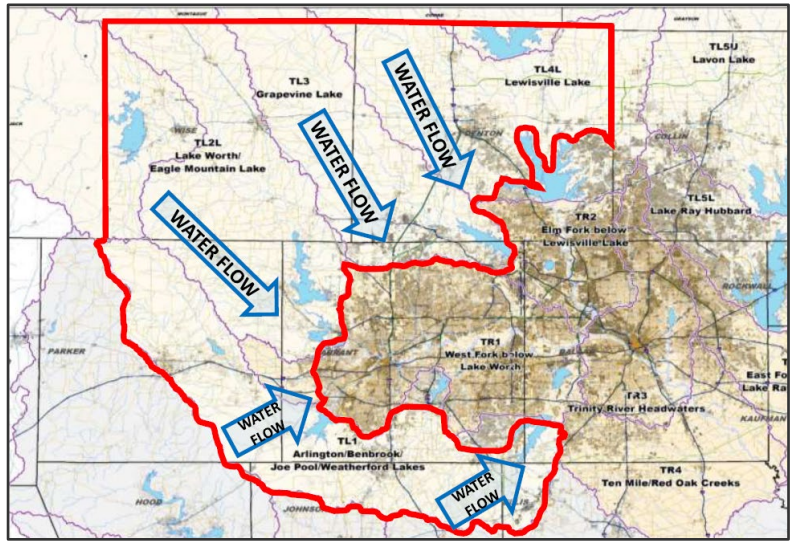
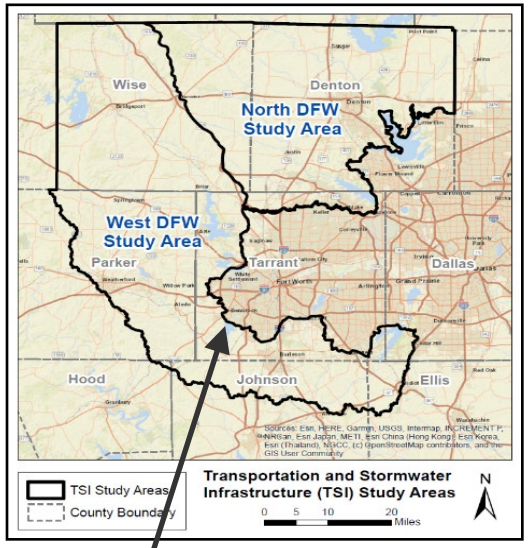
Response vs. Prevention

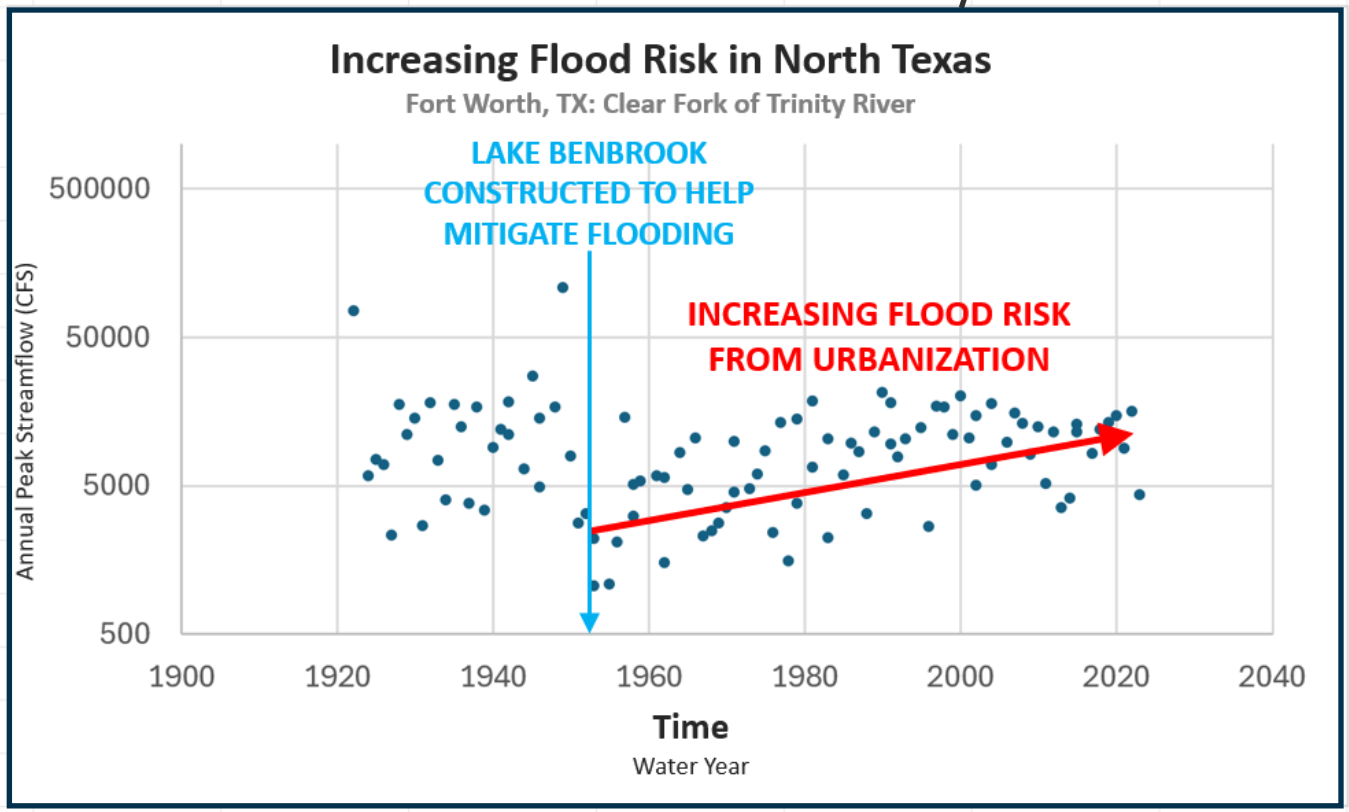
Sources: Flooded Area of Stores and Homes Near Downtown Fort Worth During Flood of 1949; https://texashistory.unt.edu/ark:/67531/metapth27965/: University of North Texas Libraries, The Portal to Texas History, https://texashistory.unt.edu; Tarrant County College NE, Heritage Room

Fort Worth – May 1949 (~11 inches of rain overnight):

- Levees breached, 10 deaths & $11M+ in damages
- *Resulted in extensive improvements to flood control infrastructure*
  - Water District (established in 1924)
  - USACE Fort Worth District (established in 1950)







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How Can *WE* Accomplish This?

- TSI benefits from valuable flood hazard awareness and resiliency information that has helped reduce uncertainty related to flood risk
- Enables us to further enhance and integrate this information at a regional scale
- Without this information, it would require extensive effort on the front end of the project to get here

Leverage existing Flood Risk Management initiatives…

… to innovate at a regional scale

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Hydrology

- Developed SOP and enhancing hydrology (including new flow locations) in pilot areas and larger West area:
  - Mary's Creek
  - Village Creek
  - Mountain Creek
  - Clear Fork
  - West Fork

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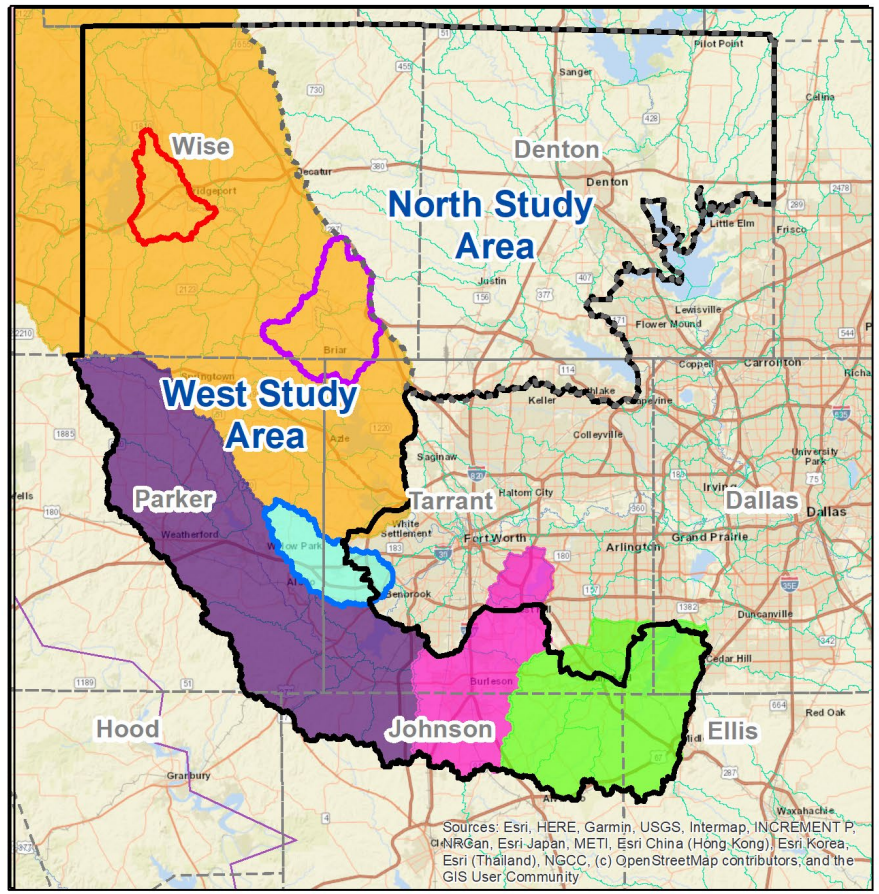
TSI Project
West Study Region
HEC-HMS Model Development SOP

May 2024

1. Delineate additional subbasins in HEC-HMS
2. Update HMS element names and descriptions
3. Calculate initial HMS parameters
4. Calibrate to InFRM WHA results
5. Update the HMS basin model for TSI current and future conditions
6. Run TSI storm scenarios
7. Model documentation
8. Submit final HMS model for review and use for team members



TSI Pilot and Hydrology Focus Areas

TSI Study Areas
County Boundary
InFRM WHA Subbasins

Eagle Mountain Pilot Area
Mary's Creek Pilot Area
Bridgeport Pilot Area

0 5 10 20 Miles

N

West Hydrology Focus Areas

Clear Fork
Marys Creek
Mountain Creek
Village Creek
West Fork

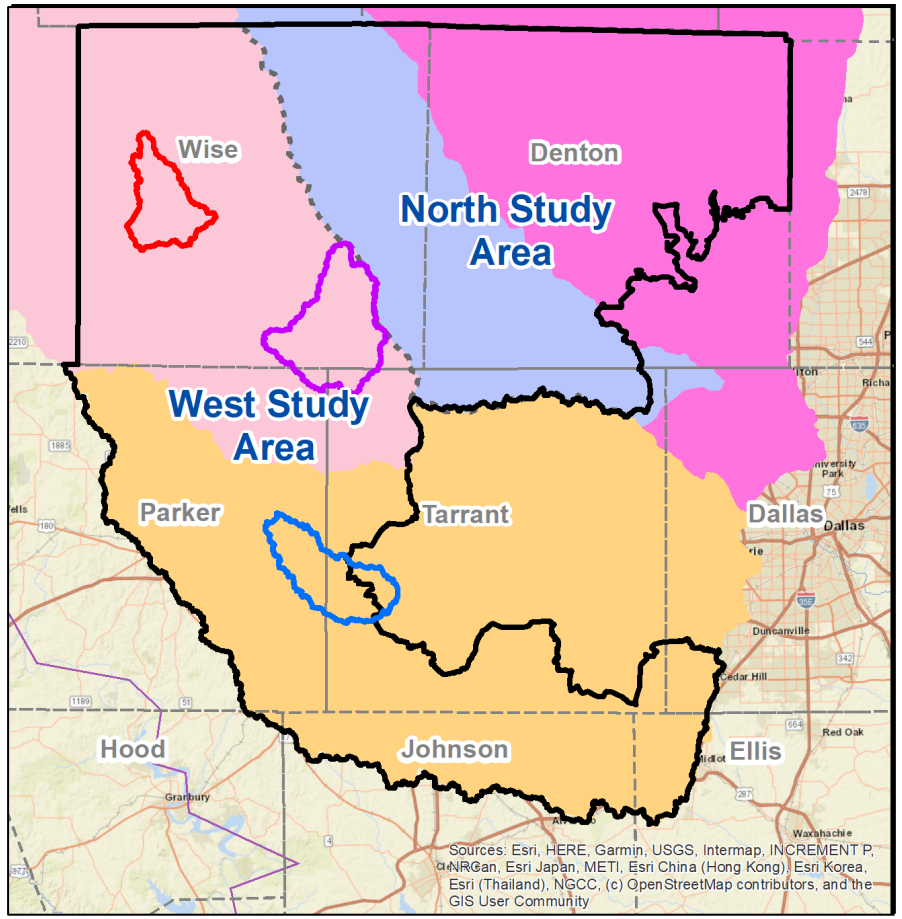
Hydraulics

- Developed SOP and enhancing hydraulic models to inform flooding considerations:
  - Defining approach for enhancing Base Level Engineering (BLE)
    - Exploring 1D vs 2D model considerations
    - Testing approaches, adding detail, urban drainage, determining environmental constraints, establish recurrence intervals, incorporate current/future flows, optimization scripting, etc.

TSI Project
West Study Region
HEC-RAS Model Development
May 2024

Defining TSI HEC-RAS Modeling Process for:

1. 1D Individual Models
2. 1D Combined Models
3. 2D Modeling



TSI Pilot Areas with BLE (as of FEB 2024)

Eagle Mountain Pilot Area
Mary's Creek Pilot Area)
Bridgeport Pilot Area
Denton: BLE AVAILABLE ON VIEWER (1D STUDY)
Elm Fork Trinity: BLE AVAILABLE ON VIEWER (1D STUDY)
Lower West Fork Trinity: BLE COMPLETE & ON VIEWER SOON (2D STUDY)
Upper West Fork Trinity: BLE AVAILABLE ON VIEWER (1D STUDY)

0 5 10 20 Miles

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BLE Viewer Link: https://webapps.usgs.gov/infrm/estBFE/

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Green Stormwater Infrastructure

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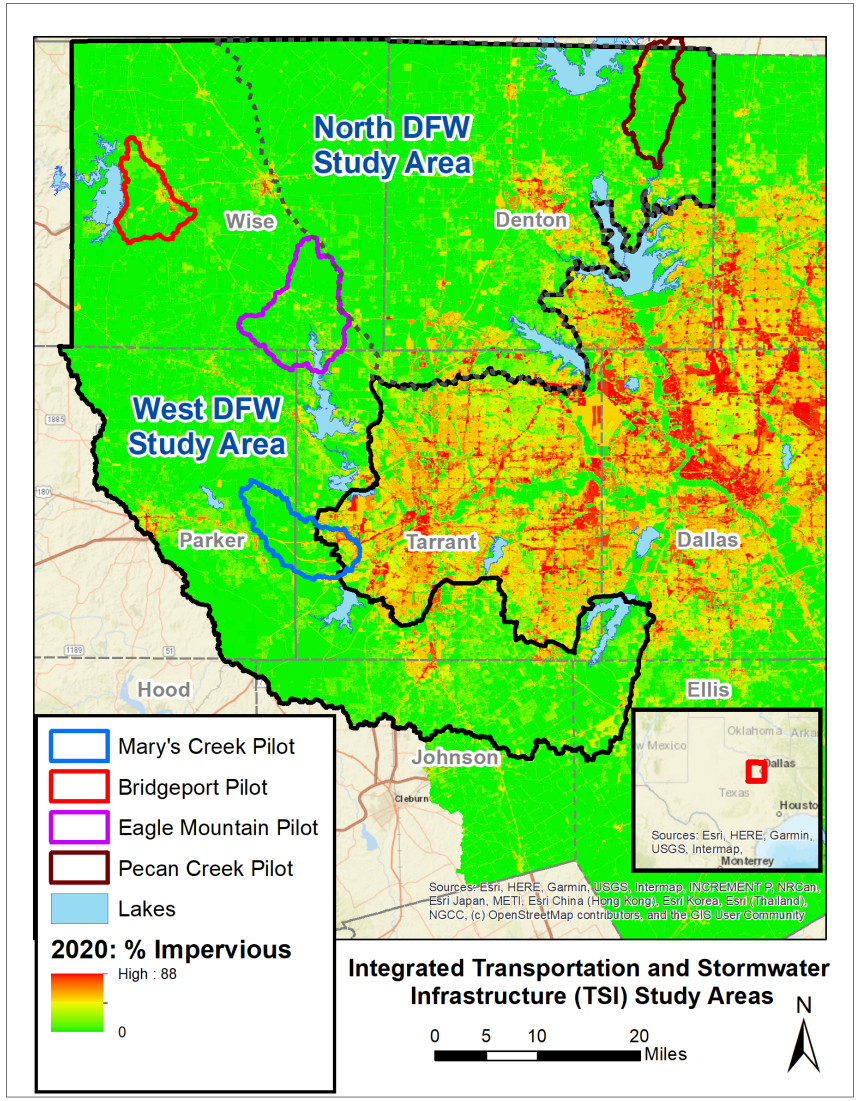
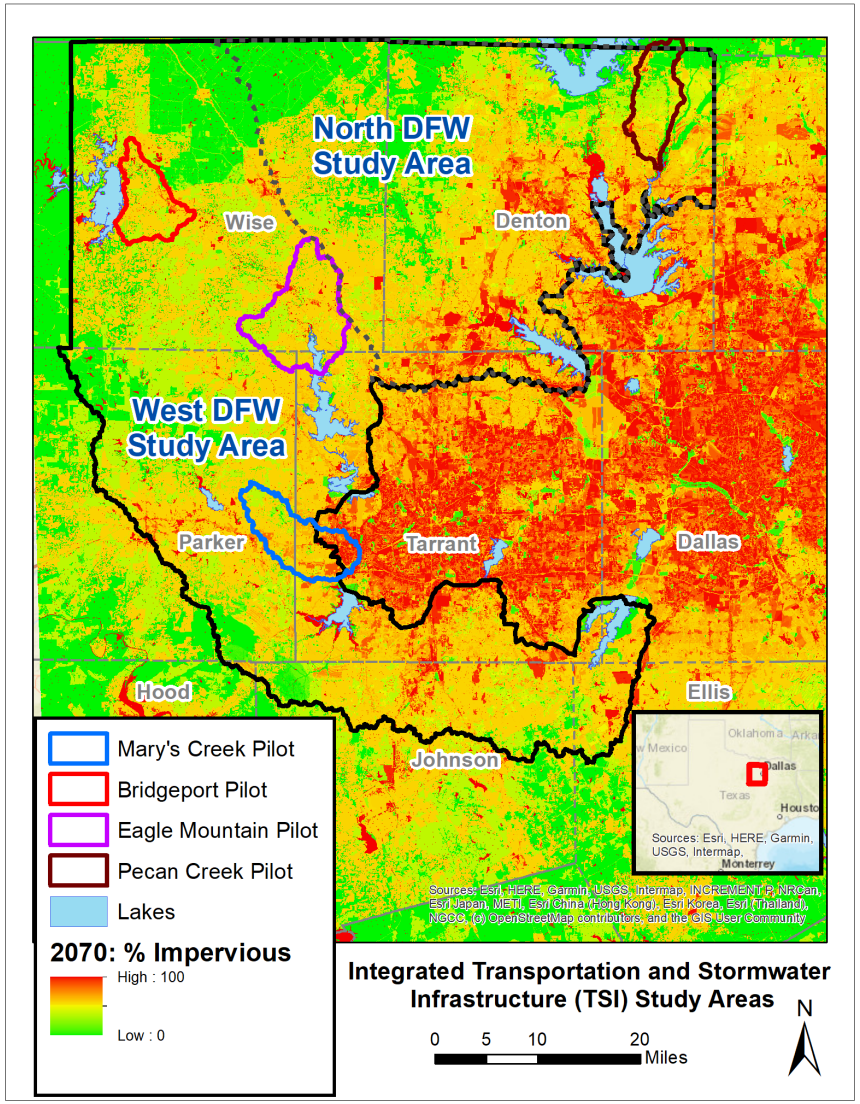
Typical Urbanization Adds Impervious Surfaces

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





Green Stormwater Infrastructure and Nature-Based Solutions Can Mitigate Increased Runoff

Menu of potential green stormwater infrastructure (GSI) and nature-based solutions (NBS) mitigation strategies

Ideal locations for GSI and NBS

Return-on-investment analysis

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Optimization Study

- The optimization study aims to model ideal **location and sizing** for detention ponds and consider potential alternatives (e.g., GSI/NBS) **to reduce downstream flows**.
- Utilizes the enhanced hydrology (HEC-HMS) models as a starting point.
- May incorporate transportation facilities at risk, regulatory tools, green infrastructure applications, scenario options, vulnerable areas, infrastructure integration options, and flood-prone and ideal GSI/NBS implementation areas where possible.
- Relies on the results of GSI and NBS suitability index based on geological, social, and environmental parameters and ranking of project types and locations.

Approach to Flood Risk Reduction
Flood susceptibility mapping

- Indicator method: Develop a flood susceptibility map using a GIS stacking model that includes four categories of conditioning factors: **Environmental, Socio-economical, Infrastructural, and Institutional**

Environmental

Topographical
- Elevation
- Slope
- LS factor
- Aspect
- Curvature
- TWI
- TRI

Meteorological
- Rainfall intensity
- Rainfall duration
- Rainfall frequency

Geological
- Geology (lithology)
- Soil hydrologic group

Hydromorphological
- SPI
- STI
- Stream order
- Distance from river
- Stream density
- Flow accumulation
- Flow direction
- Time of concentration
- Curve number

Land use/cover
- NDVI
- NDWI
- Imperviousness or NDBI

Socio-economical

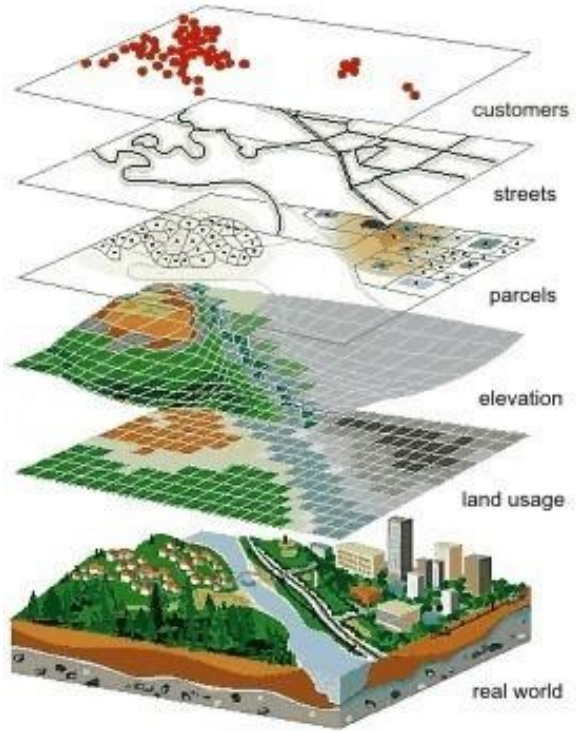
- Social vulnerability index
- Population density

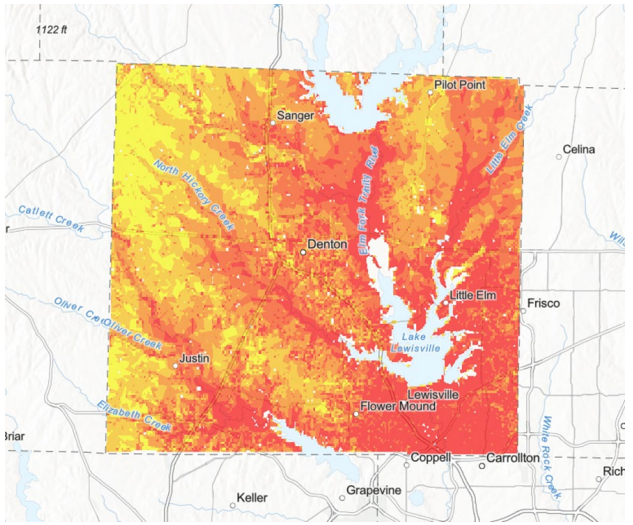
Infrastructural

- Distance from transportation network
- Distance from NRCS BMPs (ex. water harvesting catchment, pumping plant, roof runoff structure)

Institutional

- Distance from USGS streamflow monitoring gauges





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Note: Factors are summarized based on a literature review from 30 peer-reviewed journal articles over the past three years. All these factors could be considered in TSI study according to the data availability.

Result: A menu of options & integration where it makes sense

Note that these images are AI generated

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Progress and Upcoming Tasks

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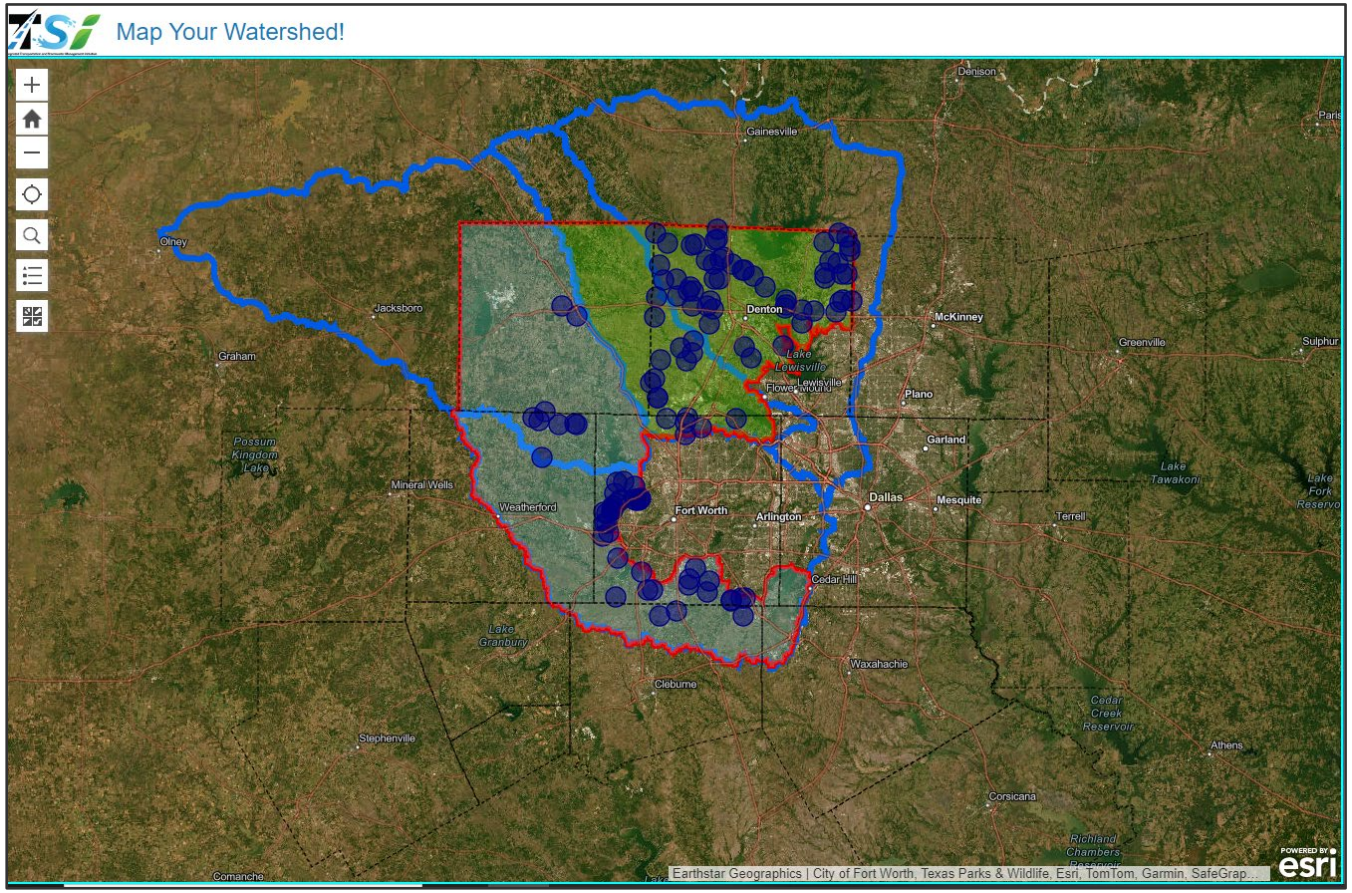
Collect and Analyze Data



North Study Area

Literature review content specific to North Study Area

Additional data sets

Additional metadata documentation

West Study Area

Literature review

Documentation of needed and desired data sets

Documentation of metadata underway

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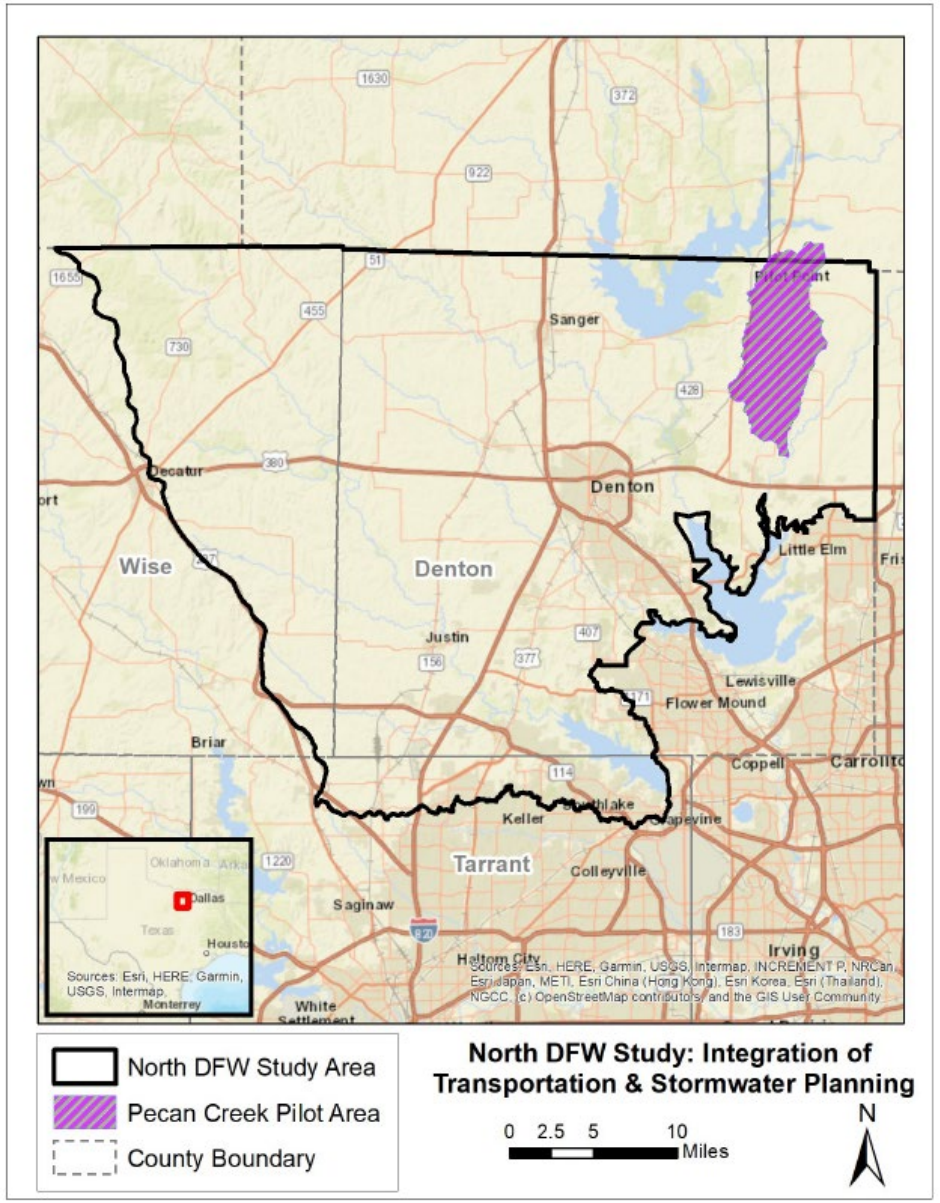

Assess Hydrology and Hydraulics and Scenarios

North Study Area

Pecan Creek Pilot Study

West Study Area

SOPs for hydrology and hydraulics methods

Three pilot study areas

Storm shifting scenarios

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Conduct Environmental Planning

North Study Area

Documentation of existing GSI and NBS planning and infrastructure

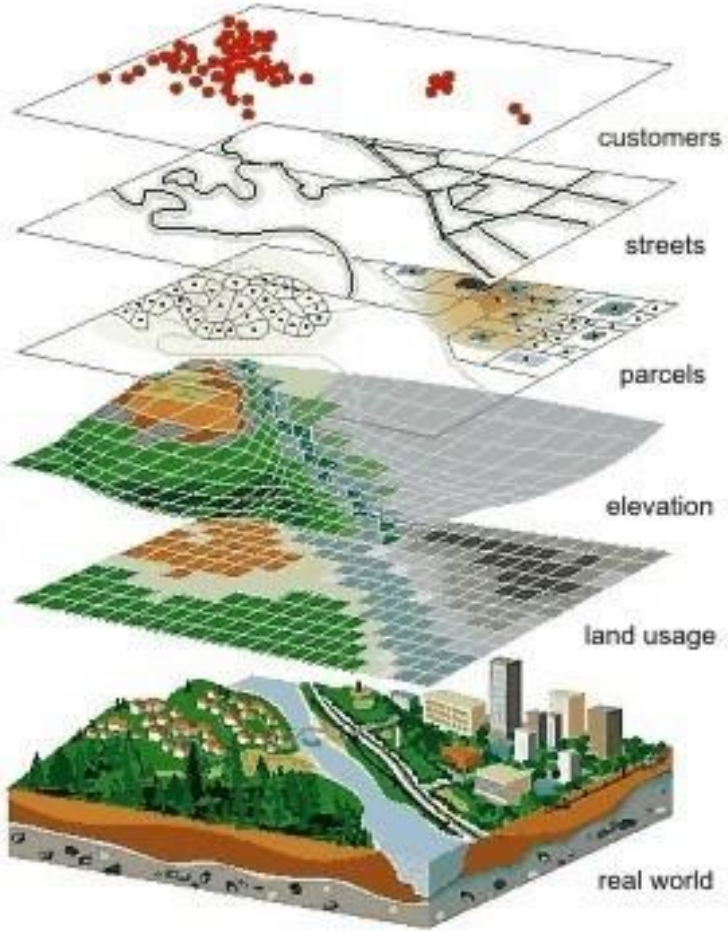
Application of stacking model to North

West Study Area

Documentation of existing GSI and NBS planning and infrastructure

GIS stacking model of suitability parameters for GSI and NBS

Optimization study to model ideal location and sizing for flood control structures



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Identify Transportation Infrastructure Impacts & Develop Decision-Making Tools

North and West Study Areas

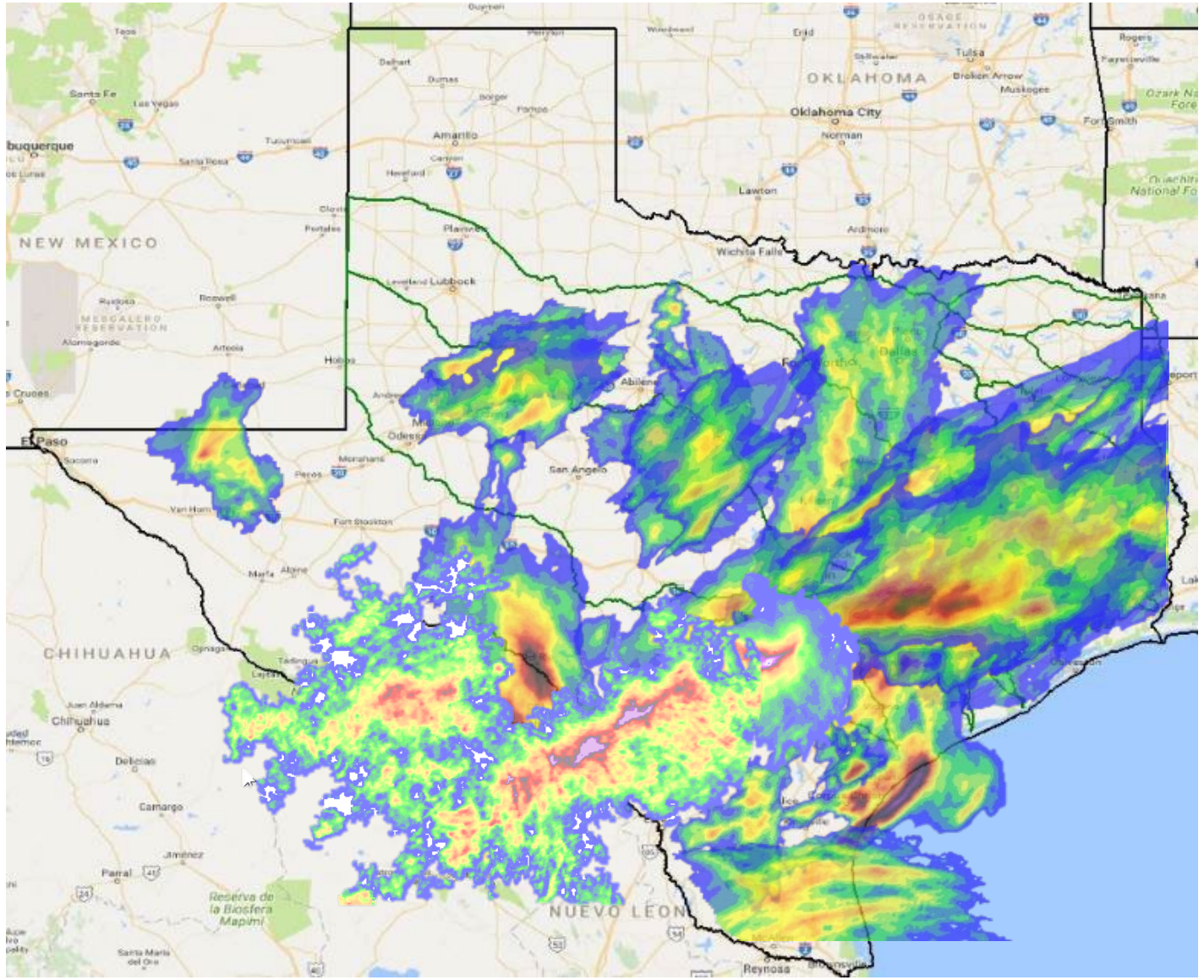
Mapping of facilities at risk of flooding

Framework for project selection and prioritization

Return-on-investment of flood mitigation

Recommendations of regulatory tools, green infrastructure, stormwater/ transportation integration strategies, sustainable infrastructure strategies

Photo courtesy of Tarrant Regional Water District



Evaluate a Real-Time Flood Warning System

North and West Study Areas

Blueprint for integrating H&H with flood warning systems

Coordination with effort funded by Regional Transportation Council

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Support & Empower Communities

North and West Study Areas

Inventory of existing codes, ordinances, and policies; model policies

Identification of incentives for conservation and preservation of floodplain

Pilot expansion of Corridor Development Certificate Program beyond current footprint (West Study Area)

Stakeholder Involvement

North Study Area

Visits to communities

Additional content during Technical Advisory Group meetings

West Study Area

Site visits to individual communities; emphasizing equity communities with FEMA funding

Online: www.nctcog.org/TSI and StoryMap

Stakeholder engagement plan

Workshop recordings

Technical Advisory Group presentations and meeting

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Document Processes

North and West Study Areas

Report documenting methods, processes, and analyses to allow for replication in other regions

Upcoming TSI Activities

Technical Advisory Group Meeting

Friday, October 25, 10:30 a.m. - noon

Microsoft Teams

Attend the meeting

Community Site Visits

In person in your community

Please reach out to a study team member to schedule a visit

Training Workshops

Potential topics:

- County Watershed Management
- Upstream/Downstream Communities Dialogue
- Others?

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Breakout Stations

Breakout Station 1:
Pecan Creek pilot study to establish technical approach for North Study Area.

Presenter: Matt Lepinski, USACE

Breakout Station 2:
Modeling considers basin characteristics and a future land use scenario to optimize mitigation strategies.

Presenter: Dr. Nick Fang, UT-Arlington

Breakout Station 3:
Site visits generated some common challenges related to flooding and development.

Presenter: Jai-W Hayes-Jackson, NCTCOG

Breakout Station 4:
An Enviroscape model promotes discussion of flooding and best management practices.

Presenter: Erin Blackman, NCTCOG

Breakout Station 5:
The StoryMap makes the case for proactive planning for flood mitigation.

Presenter: Kate Zielke, NCTCOG

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Thank You For Attending!

Please take the post-meeting survey

Paper/pen version available

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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

Project Partners

<u>West Study Area</u>

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.

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