

North Central Texas  
Council of Governments

# Technical Advisory Group Meeting

October 25, 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.

# Update on Project Progress

Progress to Date

Contracting Update

# Progress to Date

- 3 Rounds of meetings with stakeholders in the study area
- 6 Technical Advisory Group meetings
- 5 Steering Committee meetings
- 3 Workshops conducted
  - Water Rights & Green Stormwater Infrastructure
  - E&D Flooding, Stormwater, & Water Quality Programs
  - Green Asset Management Workshop
- 9 Visits to observe challenges faced by communities
  - Equity Engagement Plan written (FEMA)
  - Stakeholder Engagement Plan written
  - Literature review has been completed
  - 1D H&H Pilot Study completed
  - H&H SOPs drafted
  - H&H consultant work launched – West
  - Optimization Study underway
  - Stacking Model underway



# Contracting Update – TSI-North



## June 2024

Contract execution with Texas General Land Office



## July 2024

Requests for Proposals for H&H engineering, transportation planning, and environmental economics services



## August 2024

Review of proposals, selection of consultants



## September 2024

Highland Economics to Executive Board for environmental economics services; negotiations on interlocal agreements



## October 2024

Half Associates to Executive Board for H&H engineering and transportation planning; negotiations on interlocal agreements



## November 2024

All partners expected to be under contract and work is underway

# Contracting Update – TSI-West

## May 2024

Contract extension from Texas Department of Transportation (match funds)

## September 2024

Contract extension from Texas Water Development Board

## August 2024

Approval on partners' contract extension language from Texas Water Development Board

## November-December 2024

Contract extensions with partners

# Outreach to Local Governments

Equity Based Outreach Site Visits and StoryMap Feedback

# FEMA Equity-Based Outreach Grant

- \$100,000
- Supports outreach in both West and North study areas
- FEMA definition: Fair, just, impartial treatment
  - Communities of color
  - Members of LGBTQ+ community
  - Persons with disabilities
  - Persons who may face discrimination based on religion, national origin, and persons with Limited English Proficiency
  - Persons living in rural areas

## Stakeholder Engagement Plan

1. Identifying Stakeholders

2. Prioritizing Local Governments for Outreach

3. Preparing for Outreach to Local Governments

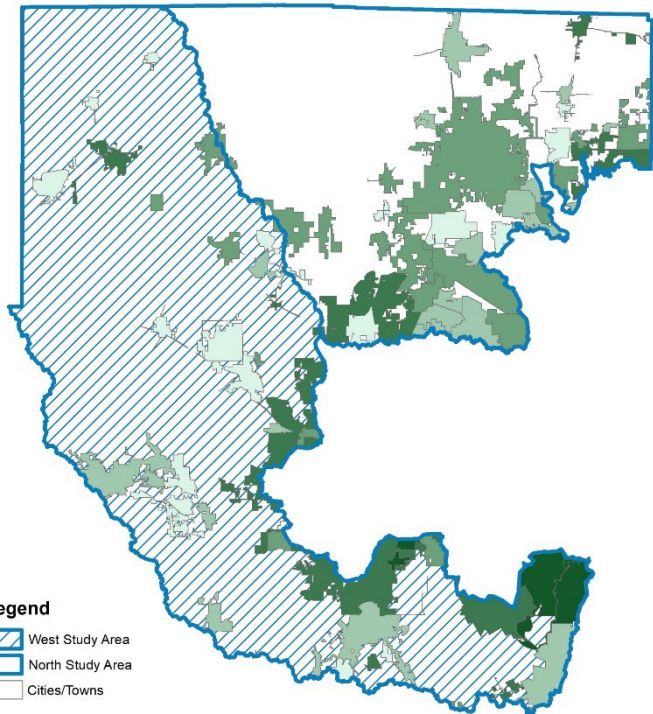
4. Following Up After Outreach to Local Governments

5. Addressing Equity

6. Reaching Rural and Agricultural Audiences

7. Reaching Business Audiences

### Communities of Color



- Legend**
- West Study Area
  - North Study Area
  - Cities/Towns
- Communities of Color**
- 7.16% - 17.36%
  - 17.37% - 29.10%
  - 29.11% - 42.77%
  - 42.78% - 62.44%
  - 62.45% - 93.11%

Data is from the American Community Survey 5-Year Estimates, 2017-2021, Table B03002. Communities of color are individuals who identify themselves as Hispanic or Latino and/or any race other than white.

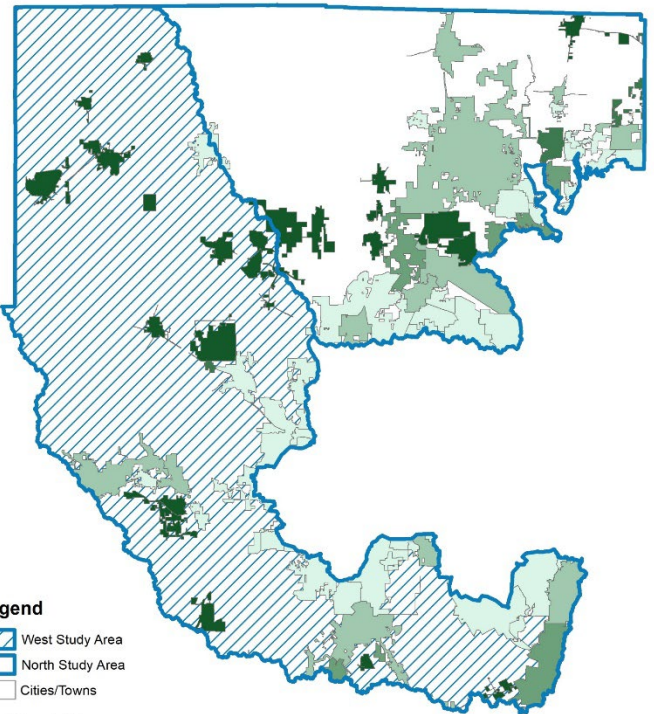
0 5 10 20 Miles

N

North Central Texas Council of Governments

January 23, 2024

### Rural Households



- Legend**
- West Study Area
  - North Study Area
  - Cities/Towns
- Rural Households**
- 0.00% - 1.58%
  - 1.59% - 6.21%
  - 6.22% - 17.30%
  - 17.31% - 59.63%
  - 59.64% - 100%

Data is from the 2020 Decennial Census, Table H2. Rural encompasses all households not included in an urban area. Urban areas were defined in 2020 as those with Census blocks of at least 2,000 housing units or with a population of at least 5,000.

0 5 10 20 Miles

N

North Central Texas Council of Governments

January 23, 2024

### FEMA Special Flood Hazard Area



- Legend**
- West Study Area
  - North Study Area
- FEMA Special Flood Hazard Area**
- Special Flood Hazard Area

Special Flood Hazard Area was downloaded from FEMA's Flood Map Service Center. This area is defined by FEMA as the area that will be inundated by the flood event having a 1-percent change of being equaled or exceeded in any given year.

0 5 10 20 Miles

N

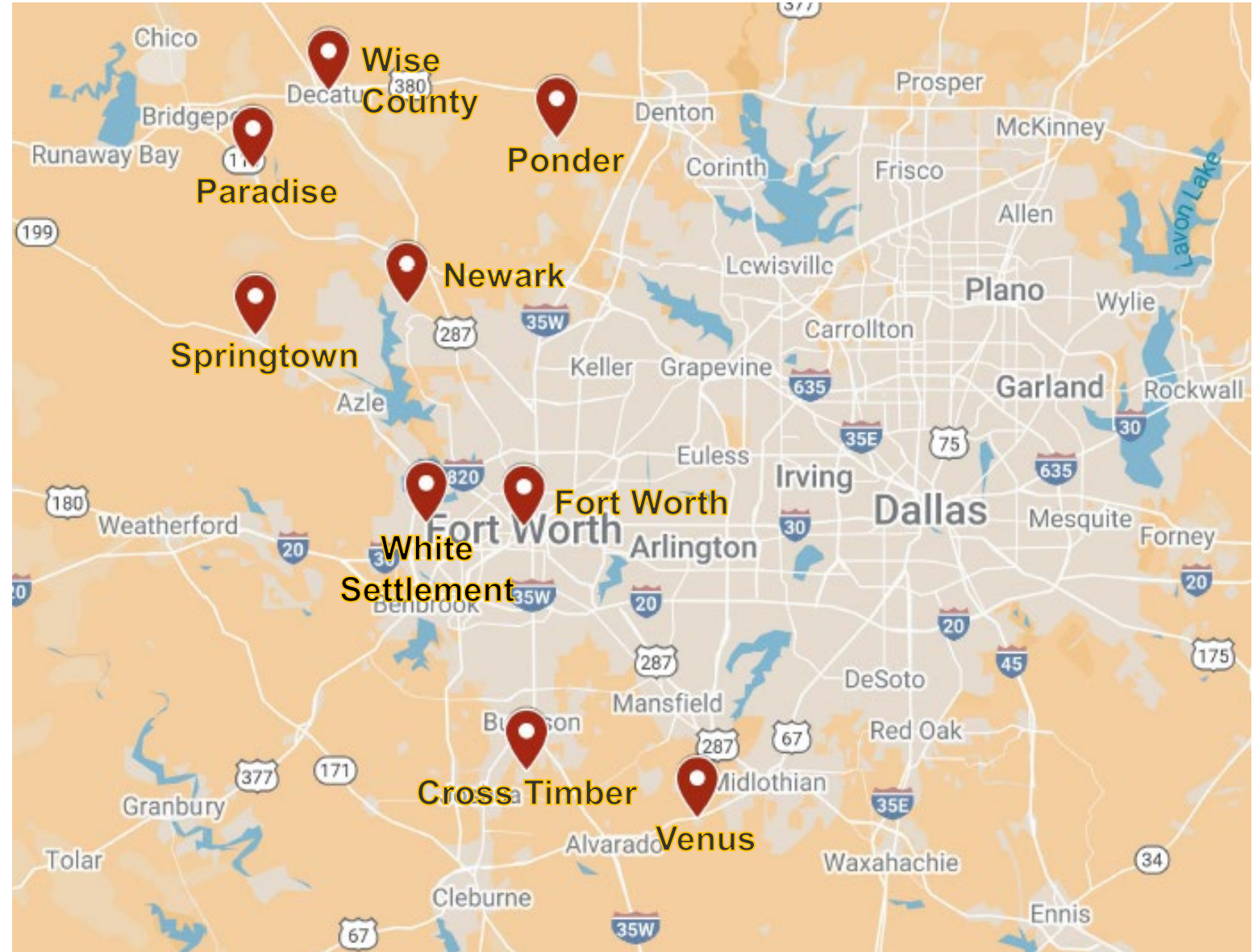
North Central Texas Council of Governments

January 24, 2024



# Communities Visited

- Cross Timber
- Fort Worth
- Newark
- Paradise
- Ponder
- Springtown
- Venus
- White Settlement
- Wise County



# Common Themes from Community Visits

- Developer Relationships and Policy
  - “Relationship depends on the developer.”
  - “Communities are changing their development criteria to remove “grey areas”
  - S.B. 2038: ETJ Bill
  - H.B. 3699: Shot Clock Bill
- Growth Challenges and Opportunities
  - Everyone is trying to get ahead of growth
  - “Land availability is a challenge.”
  - Prioritizing high-density developments
- Green Stormwater Infrastructure
  - Counties are interested incorporating GSI for aquifer recharge to address water supply
  - “GSI is a good idea, concerned with how to maintain.”
  - “Need more resources.”



# StoryMap Feedback

*This feedback was obtained during the September Subarea Meetings:*

- Do you think it is feasible to distribute TSI final products and recommendations via the [StoryMap](#)?
  - “Graphics and StoryMap help visually deliver project goals and strategies.”
  - “Have everything in one place to make it easy for communities to find.”
- What components of the StoryMap did you find most interesting or useful?
  - It tells a story
  - Links
  - Maps
  - Facts and figures
- What additional information would you like included in the StoryMap?
  - Pictures of cities before and after flooding
  - Direct links to resources and websites
  - Sign up for future meetings

# Technical Topics

H&H Pilot Study, Optimization, and Stacking Model Updates

# Hydrology

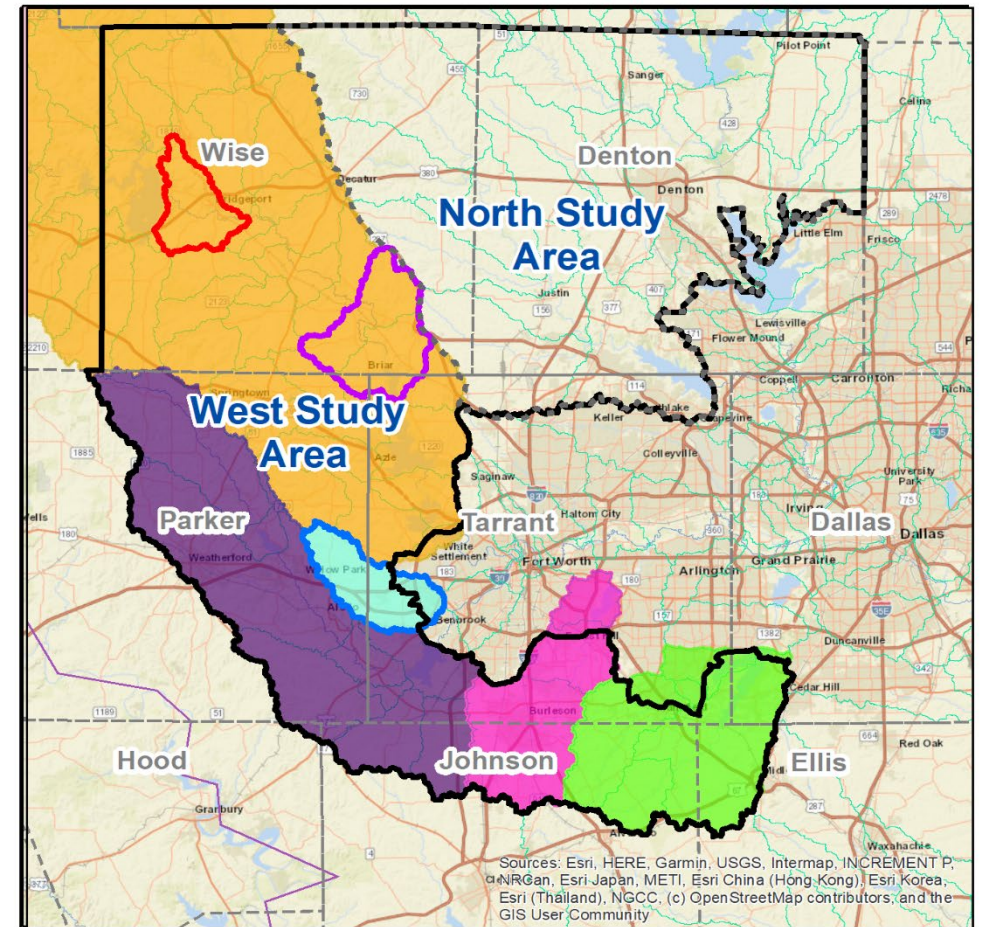
Developed SOP and enhancing hydrology (including new flow locations) in pilot areas and larger West area:

- Mary's Creek
- Village Creek
- Mountain Creek
- Clear Fork
- West Fork

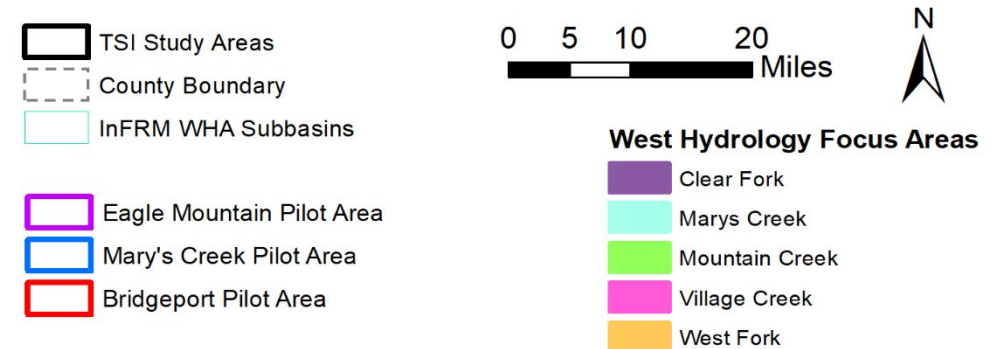
TSI Project  
West Study Region  
HEC-HMS Model Development SOP  
May 2024

1. Overview of the HMS Model Development for TSI	2
2. Data Sources	2
2.1 GIS Data	2
2.2 Model Data	3
3. Subbasin Locations	3
4. HEC-HMS Methodology	4
4.1 Pilot Example	4
4.2 Subbasin Delineations in HEC-HMS	4
4.3 Update HEC-HMS Element Names and Descriptions	6
4.4 Initial HMS Parameters Calculations	9
4.5 Calibration to InFRM WHA Results	17
4.6 Update the HEC-HMS Basin Model for TSI 2020 Conditions	20
4.6.1 TSI Existing Conditions for 2020	20
4.6.2 Run the 100-yr Storm for 2020 Conditions	21
4.7 Run TSI 2020 Storm Scenarios	21
4.8 Model Documentation	22
4.9 Interim Review 4 - Final Existing Conditions HEC-HMS Model	22
4.10 Update the HEC-HMS Basin Model for TSI Future Conditions	22
4.10.1 TSI 2070 Future Conditions Basin Model	23
4.10.2 Run the 100-yr Storm for 2070 Future Conditions	23
4.10.3 Run TSI Storm Scenarios for Future Conditions	24
4.11 Model Documentation	25
4.12 Final Review 5 - Final Future Conditions HEC-HMS Model	25
5. Additional Considerations for the Hydrology of the West Fork	25

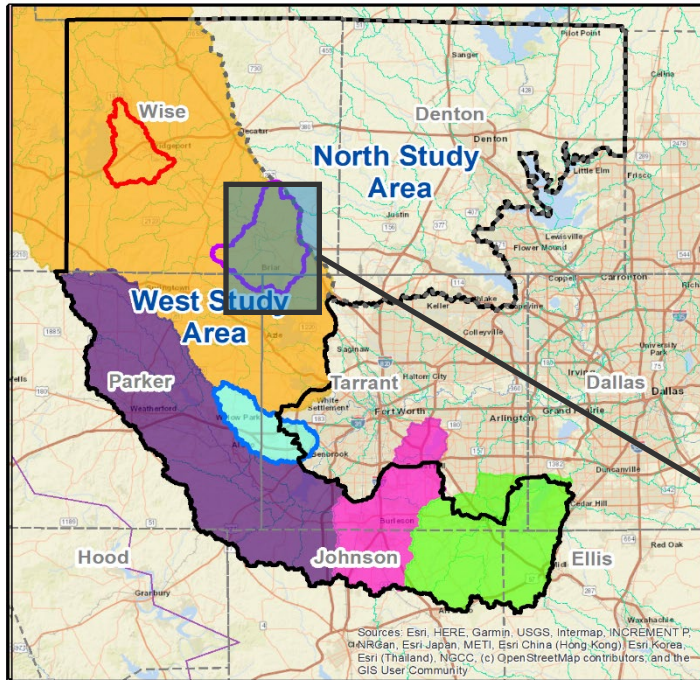
1. Delineate additional subbasins in HEC-HMS
2. Update HMS element names and descriptions
3. Calculate initial HMS parameters
4. Calibrate to InFRM WHA results
5. Update the HMS basin model for TSI current and future conditions
6. Run TSI storm scenarios
7. Model documentation
8. Submit final HMS model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



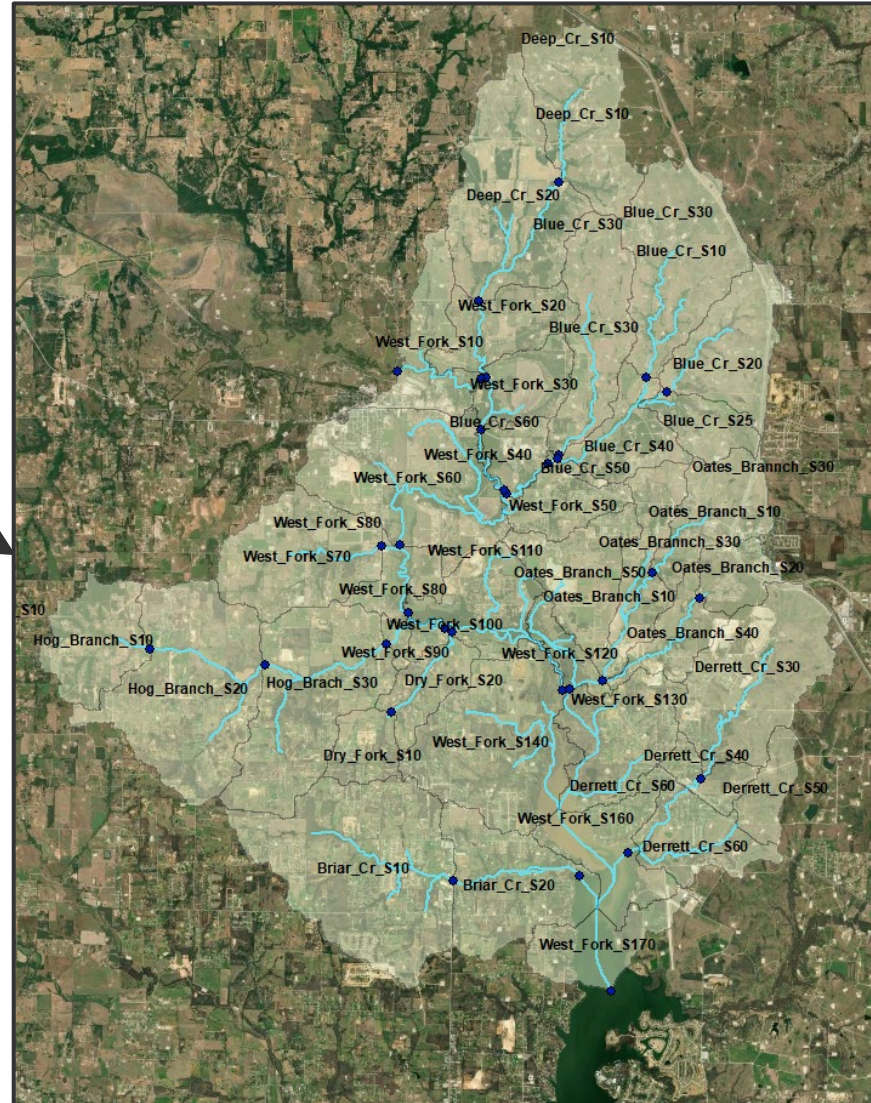
TSI Pilot and Hydrology Focus Areas



# Hydrology Enhancement Example: Eagle Mountain Pilot



TSI Pilot and Hydrology Focus Areas



Final hydrology delineation for TSI Eagle Mountain Pilot Area

# Hydraulics

Developed SOP and enhancing hydraulic models to inform flooding considerations:

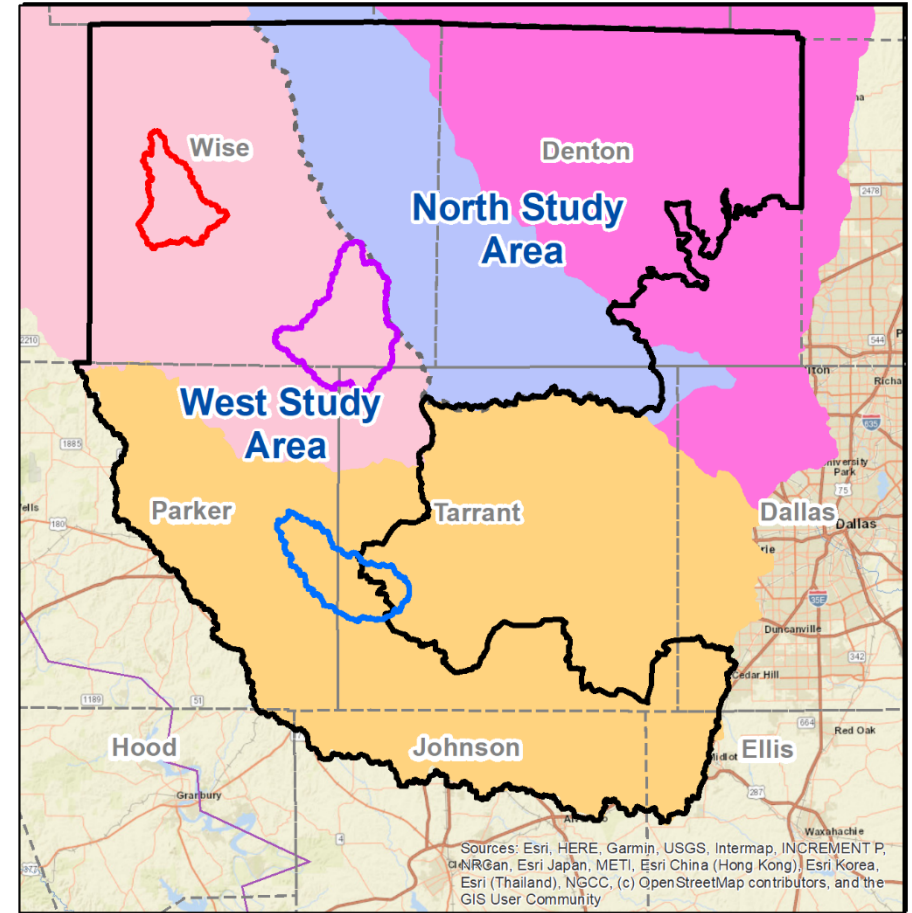
- Defining approach for enhancing Base Level Engineering (BLE)
  - Exploring 1D vs 2D model considerations
  - Testing approaches, adding detail, urban drainage, determining environmental constraints, establish recurrence intervals, incorporate current/future flows, optimization scripting, etc.

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

1	Overview of the Hydraulic Model Development for TSI	2
2	Data Sources	2
2.1	GIS Data	2
2.2	Model Data	2
3	HEC-RAS Methodology Development	3
3.1	Eagle Mountain Pilot	3
3.2	HEC-RAS Modeling Process	3
3.2.1	1D BLE Individual Models	3
3.2.2	1D Combined Models	11
3.2.3	2D Modeling	14
4	Model Methodology Comparison, Discussion, and Recommendation	22

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)

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

# Hydraulics Data Source: Base Level Engineering (BLE)

## What?

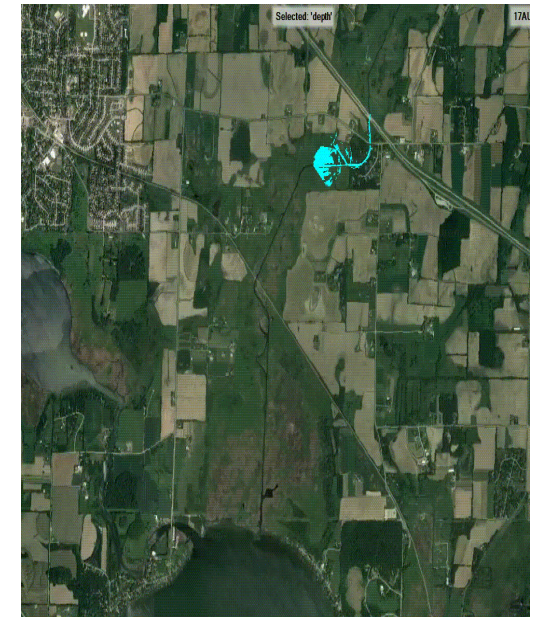
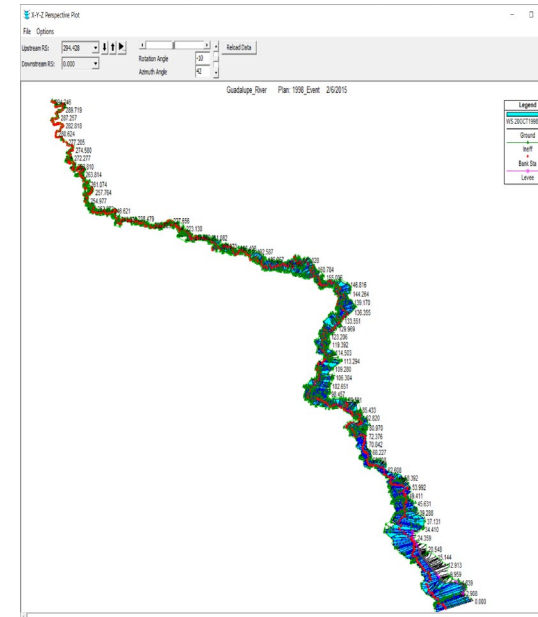
Watershed-wide engineering modeling method that leverages high resolution ground elevation, automated model building techniques, and manual model review to prepare broad and accurate flood risk information.

## Why?

Centralized and available flood hazard analysis to support floodplain management activities and development review, while increasing risk awareness for individuals.

## Outcome:

- Quickly determine the flood risk for various events throughout multiple watersheds at various recurrence intervals (i.e., 10yr, 100yr, 500yr).
- Allows Federal, State, and local governments, as well as individuals, to access and use flood risk information.





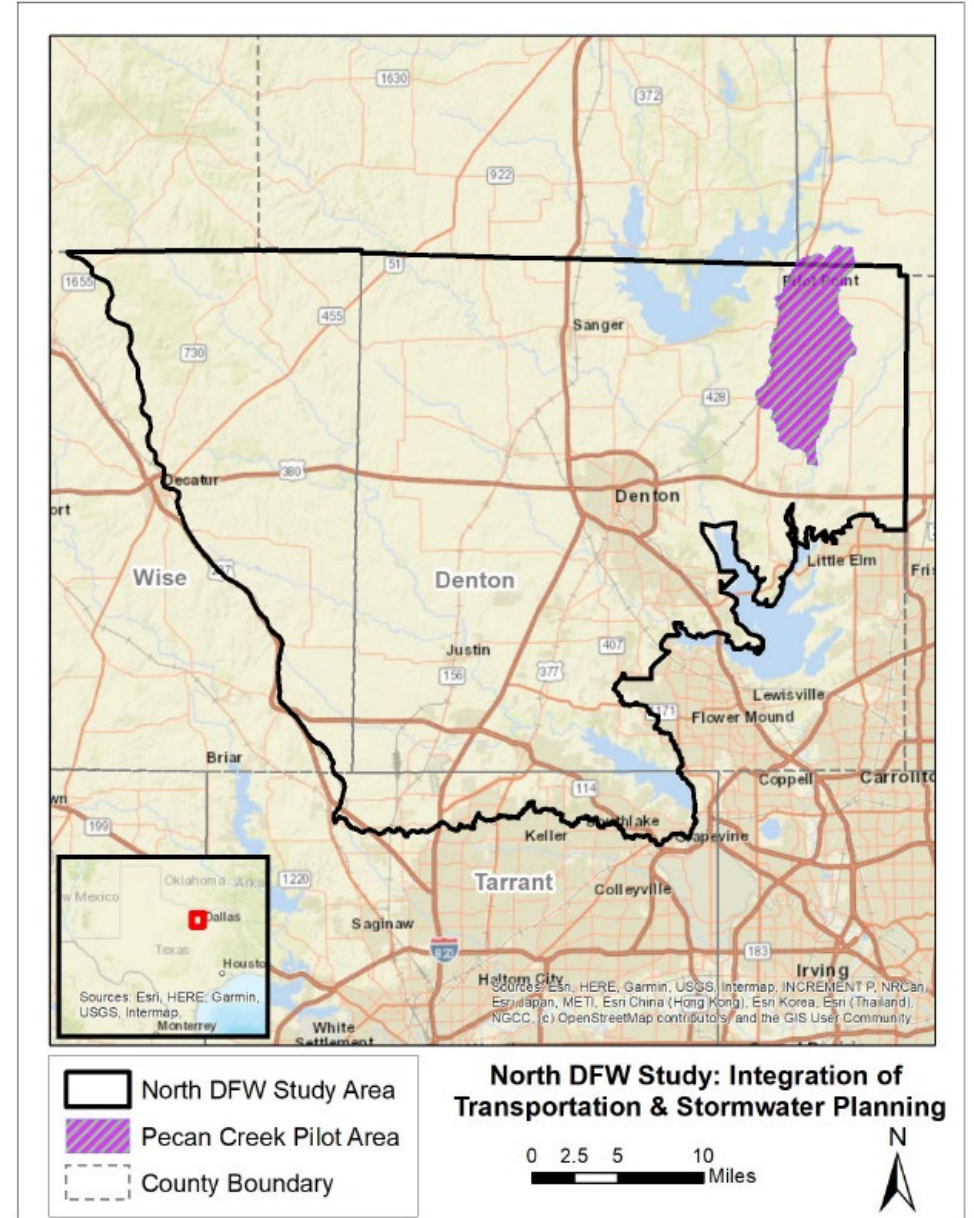
# North Study Area: Pecan Creek Pilot Study

## Pecan Creek Pilot Study

The purpose of this Pecan Creek H&H Pilot study is to establish a technical approach and provide foundational analysis that can be expanded through the larger North DFW TSI study. This includes investigation, data collection, and H&H model enhancements for existing and future conditions within the Pecan Creek Area.

### Deliverables:

- Enhanced hydrologic modeling for the Pecan Creek Area of the Trinity River Watershed Hydrology Assessment (WHA) study
- Enhanced hydraulic modeling for the Pecan Creek Area of the FEMA Base Level Engineering (BLE) study
- Coordination with planning, transportation, and environmental reviews
- Retrieval and documentation of existing H&H information for inclusion in literature review
- Summary of findings and recommendations for expanded services



# Technical Topics

## Optimization Overview

# TSI Optimization Overview

- 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** due to anticipated changes in imperviousness, using updated HEC-HMS models.
- The study considers input from the transportation (facilities at risk, vulnerable areas) and environmental (GSI/NBS, flood-prone areas) perspectives.
  - Specifically, the GSI and NBS suitability index helps to provide a foundation for where GSI/NBS can be proposed.
  - Investigating ways to incorporate transportation elements into the TSI optimization effort is going.

# TSI Optimization: Eagle Mountain HEC-HMS Model

No. of Subbasins: **41**

No. of Reaches: **42**

Outlet (Sink): **1**

Total Area: **75.2 sq mi.**

Avg. Increase in Imperviousness: **+24.89%** (max: 46.88%)

Avg. Decrease in Lag Time : **-0.41 hrs** (max: -0.67 hrs)

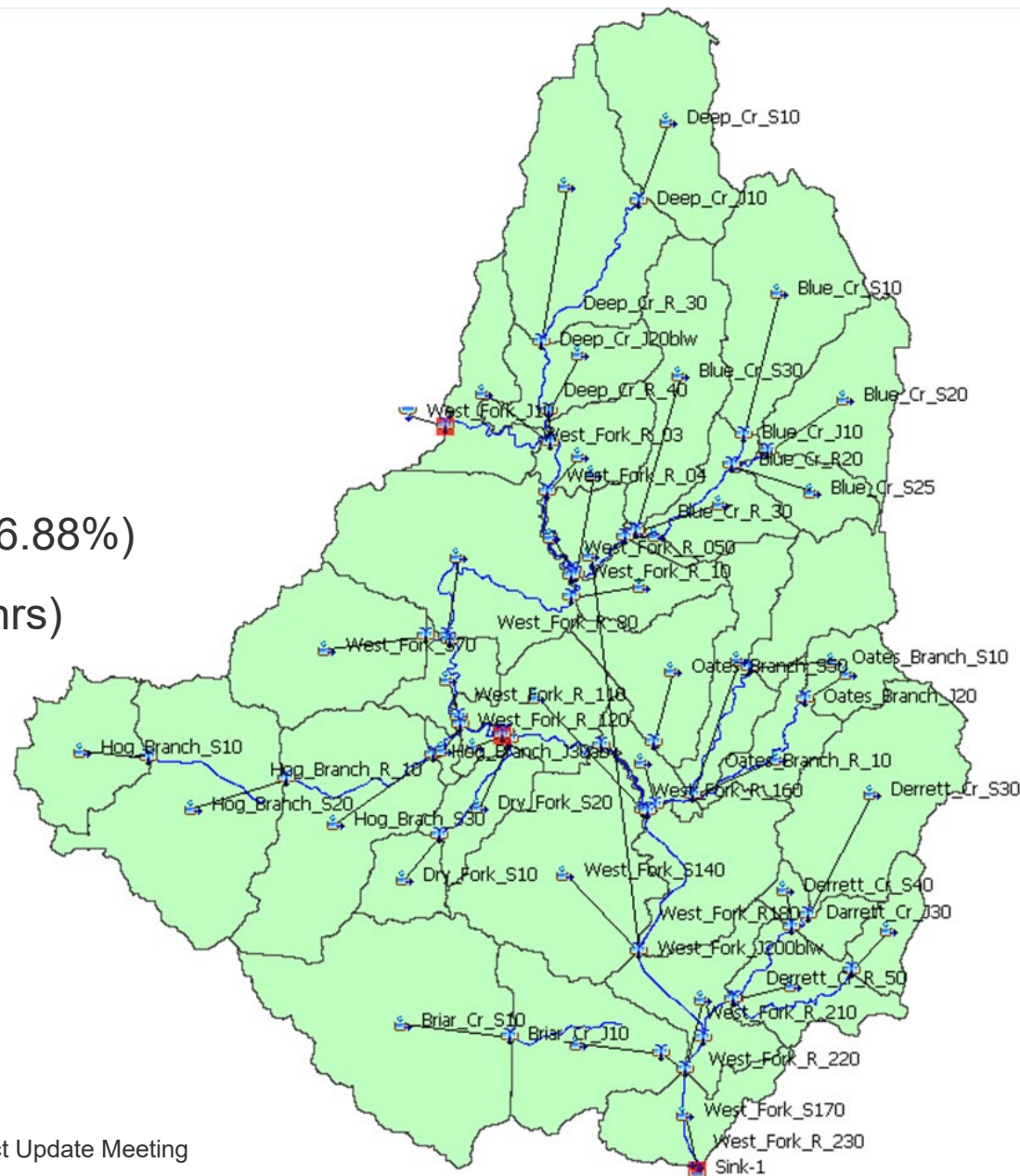
Without Inflow

Sink Discharge (2020): **40,252 cfs**

Sink Discharge (2070): **51,143 cfs**

**10,891 cfs increase**

Theoretical Storage Required = **6,211 acre-ft**

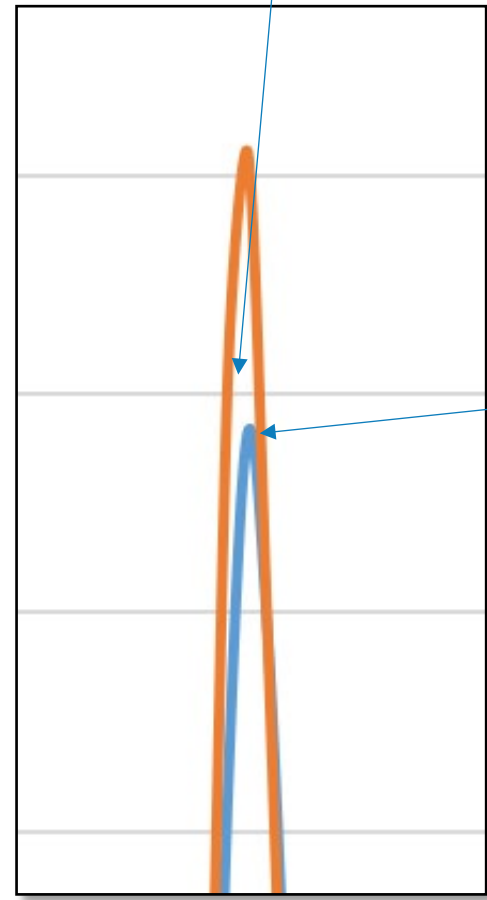


# TSI Optimization: Storage-Discharge Curve

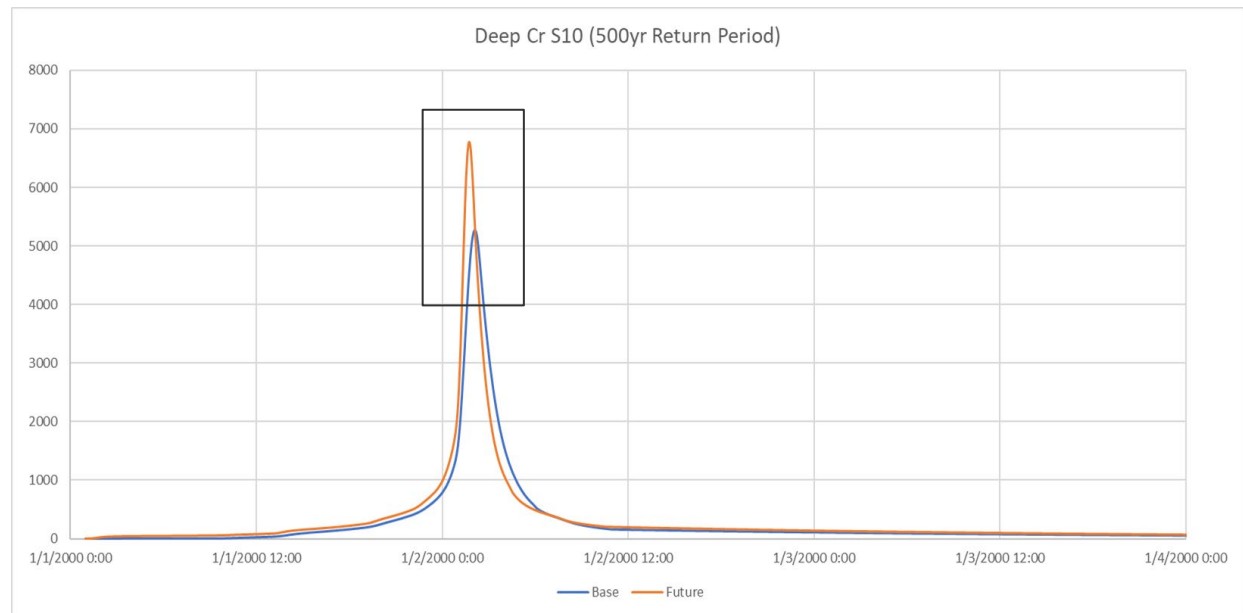
Positive Storage Difference

Storage (Acre-Ft)	Discharge (CFS)	Return Period
0	0	
557.14	60.01	2yr
562.17	1859.4	10yr
582.41	3665.8	50yr
613.83	4155.4	100yr
722.19	5266.8	500yr

Peak Base Discharge

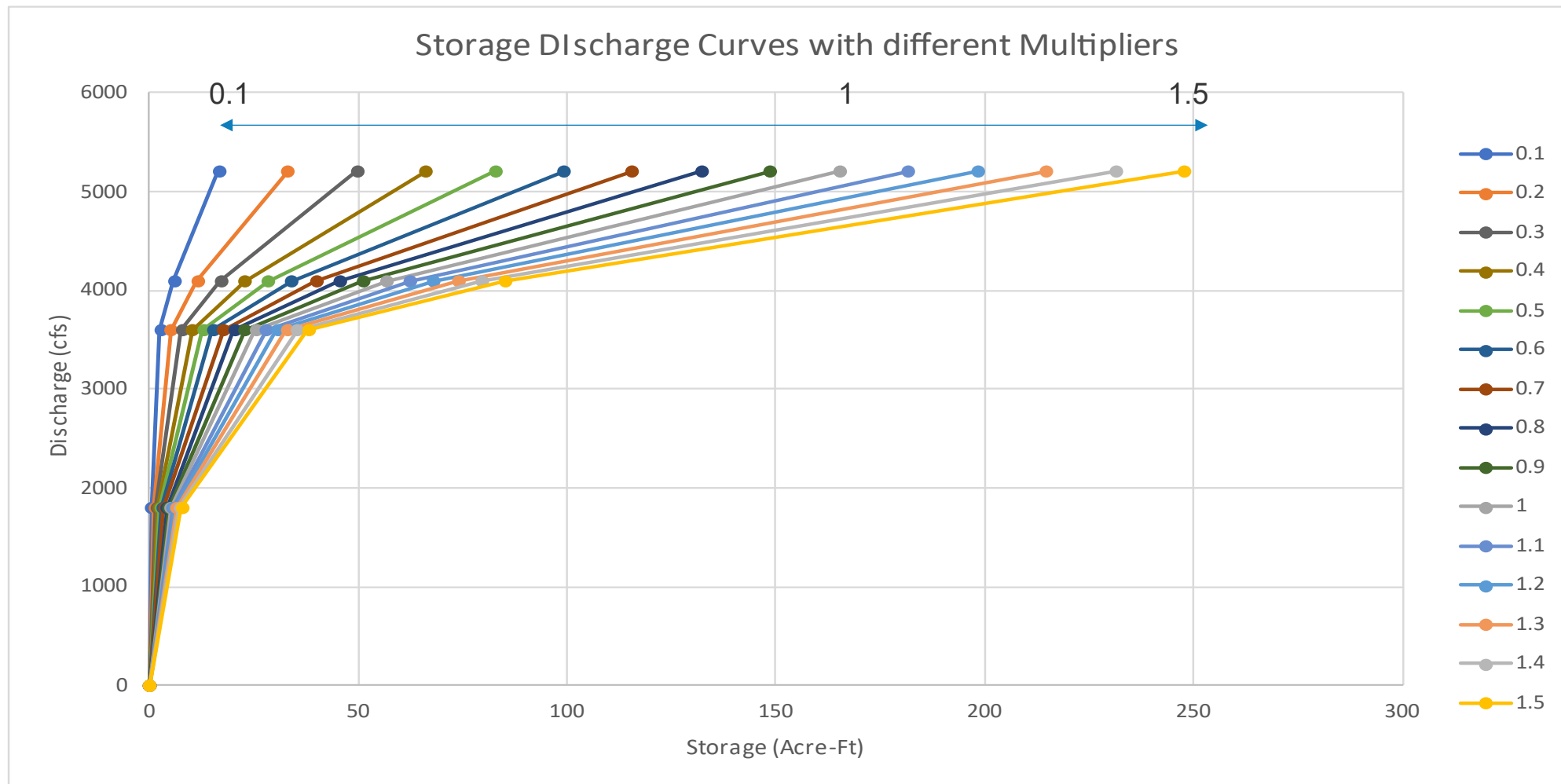


— Base — Future



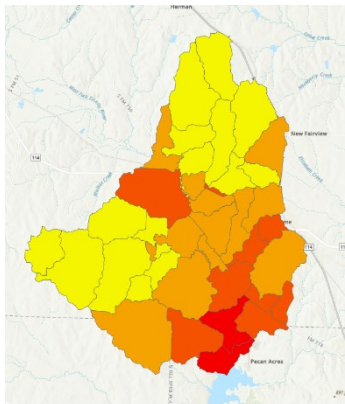
# TSI Optimization: Storage-Discharge Curve Multipliers

Storage values are multiplied with different multipliers while the discharge values are kept constant resulting in different variants of the original storage-discharge curves with different slopes.



# TSI Optimization: Pilot Study Methodology

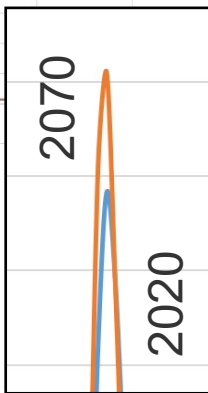
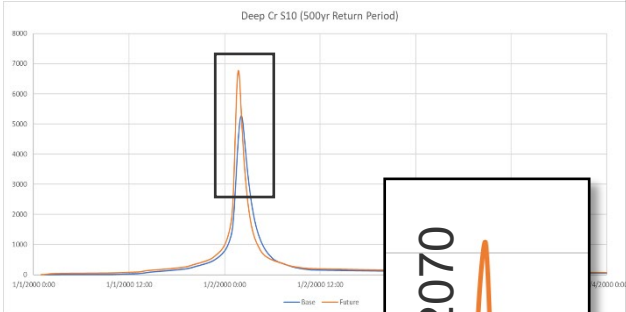
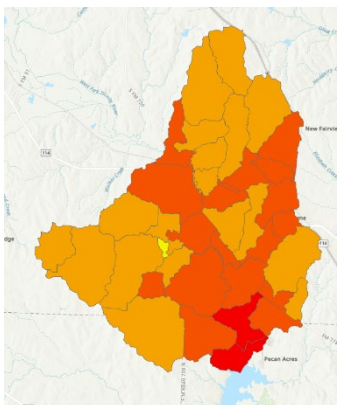
2020



Increased Imperviousness

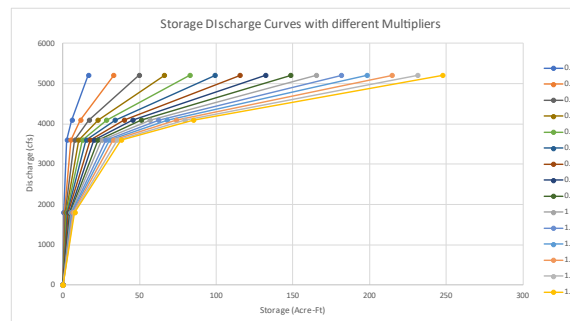


2070



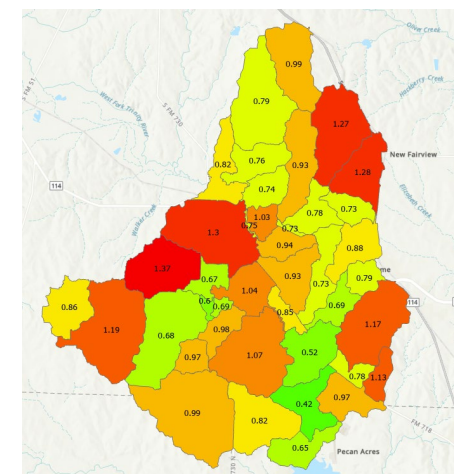
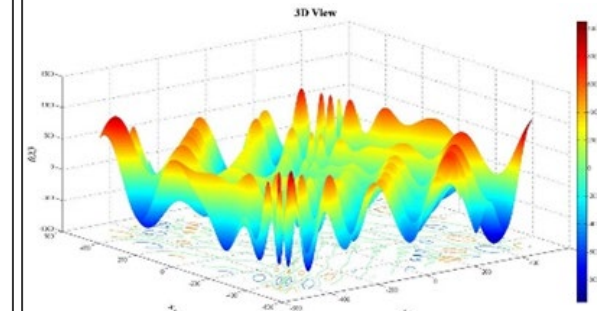
Increase in Flow

## Setting Up HEC HMS Model with Reservoirs



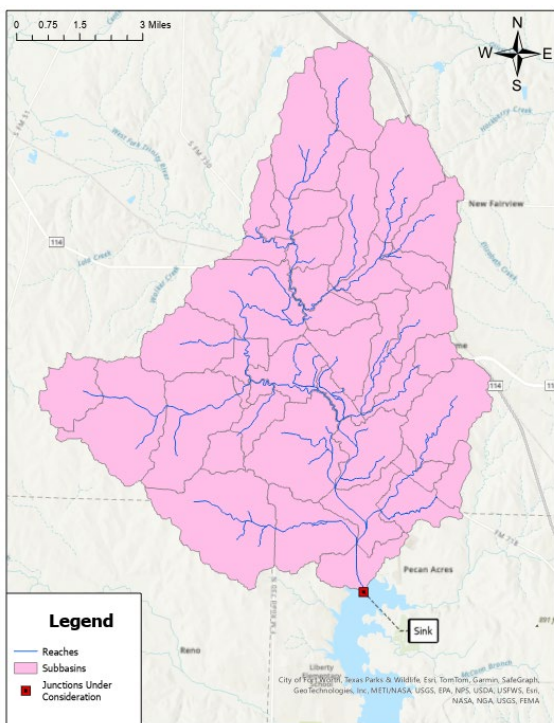
Varying Storage Values to Best Reduce the Peak Flow

## Optimized Storage Values Generated from HMS Runs



# TSI Optimization: Most Optimal Solution (1 Discharge Limit)

Junctions	Description	Limiting Discharge (cfs)
Sink	Outlet of the Basin	40252



Peak Discharge at Sink: **40,185** cfs  
 Total Storage: **4,123** Ac-ft

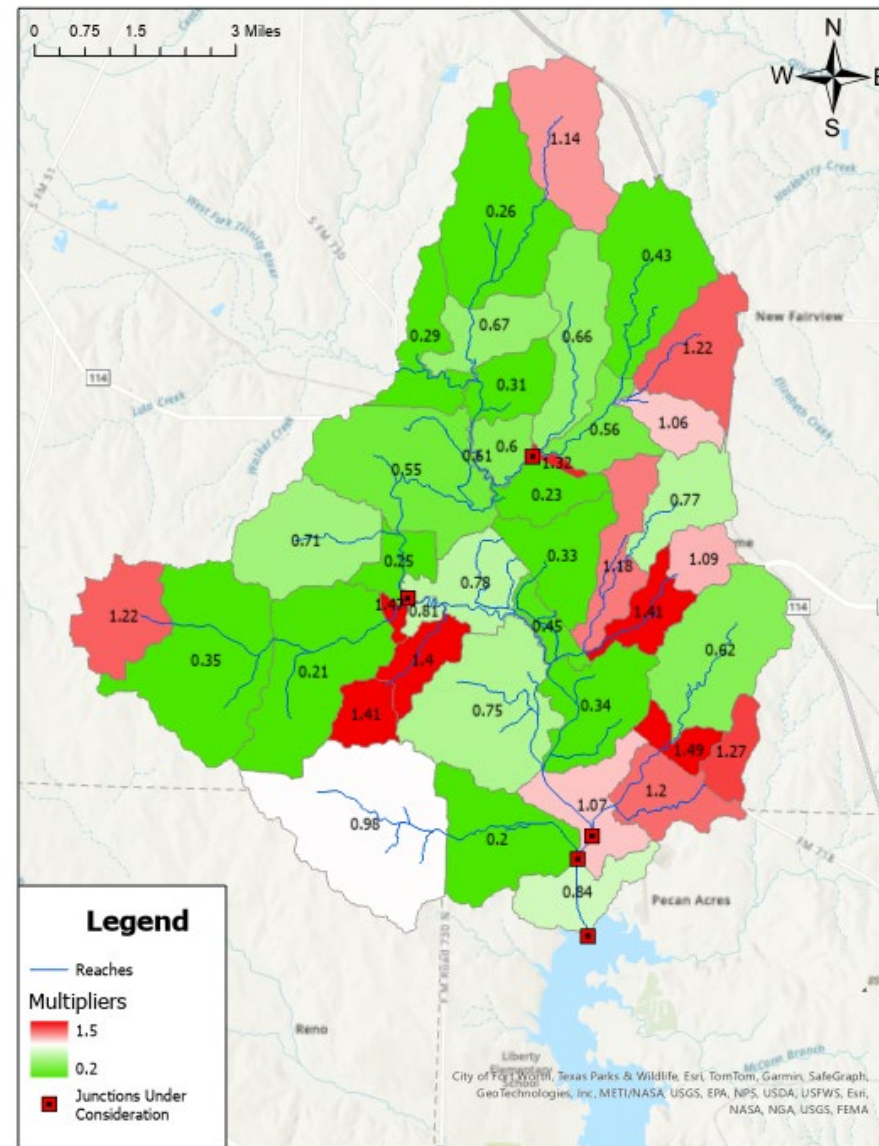


## Reference

Sink Discharge (2020): **40,252** cfs

Sink Discharge (2070): **51,143** cfs

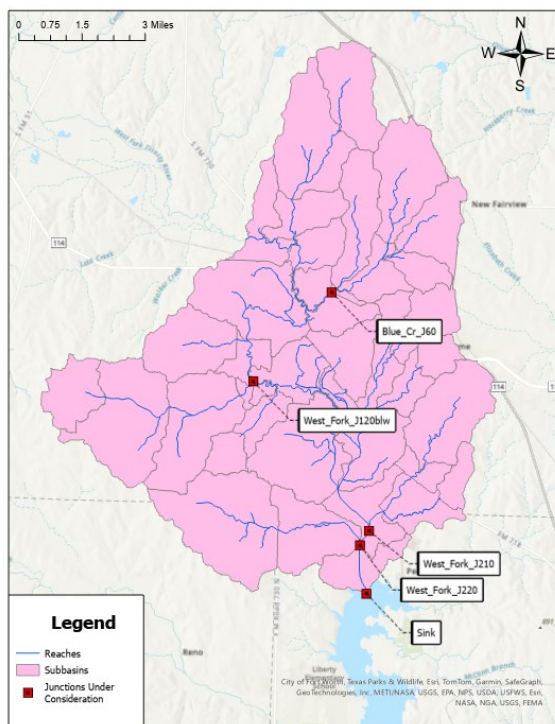
Theoretical Storage Required = **6,211** Ac-ft





# TSI Optimization: Most Optimal Solution (5 Discharge Limits)

Junctions	Description	Limiting Discharge (cfs)
Blue_Cr_J60	Crosses SH114	11085
West_Fork_J120blw	Merges with Hog Branch	20648
West_Fork_J210	Merges with Darrett Creek	27050
West_Fork_J220	Merges with Briar Creek	38866
Sink	Outlet of the Basin	40252



Peak Discharge at Sink: **39,191** cfs  
Total Storage: **5,472** Ac-ft

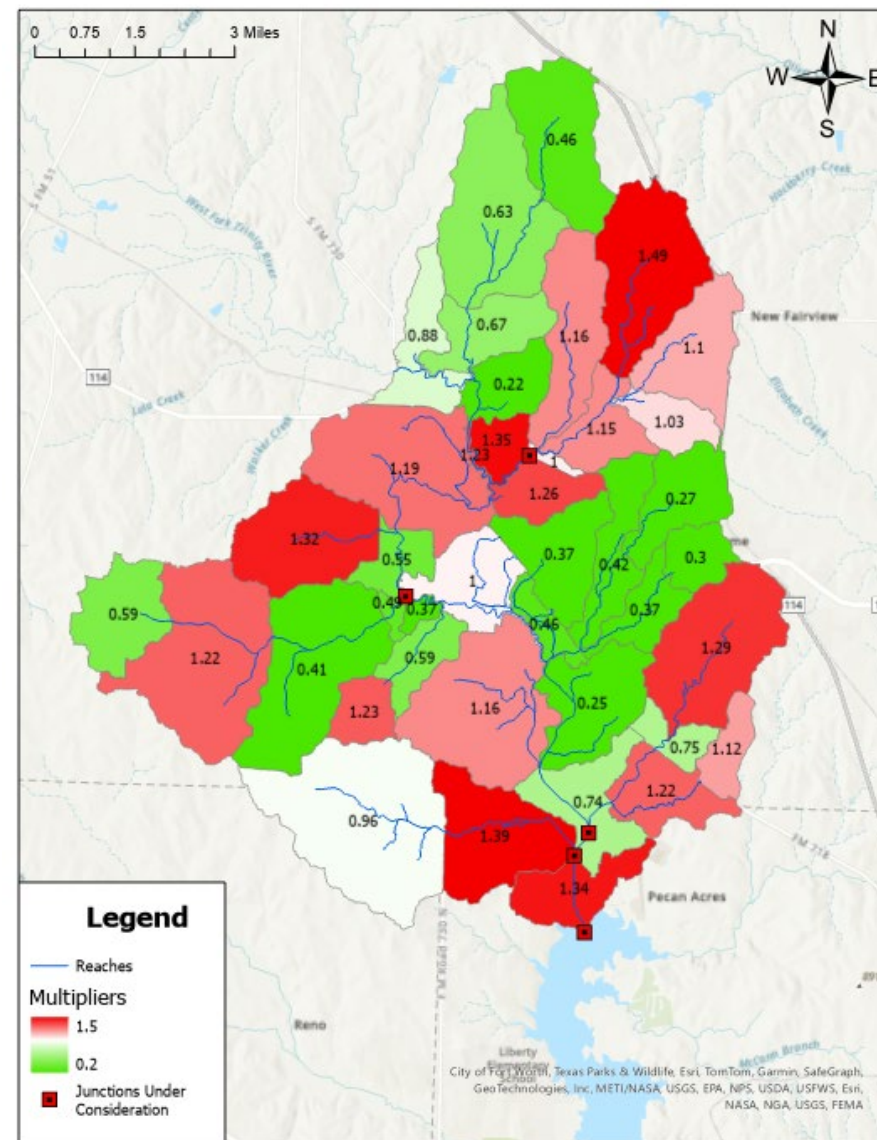


## Reference

Sink Discharge (2020): **40,252** cfs

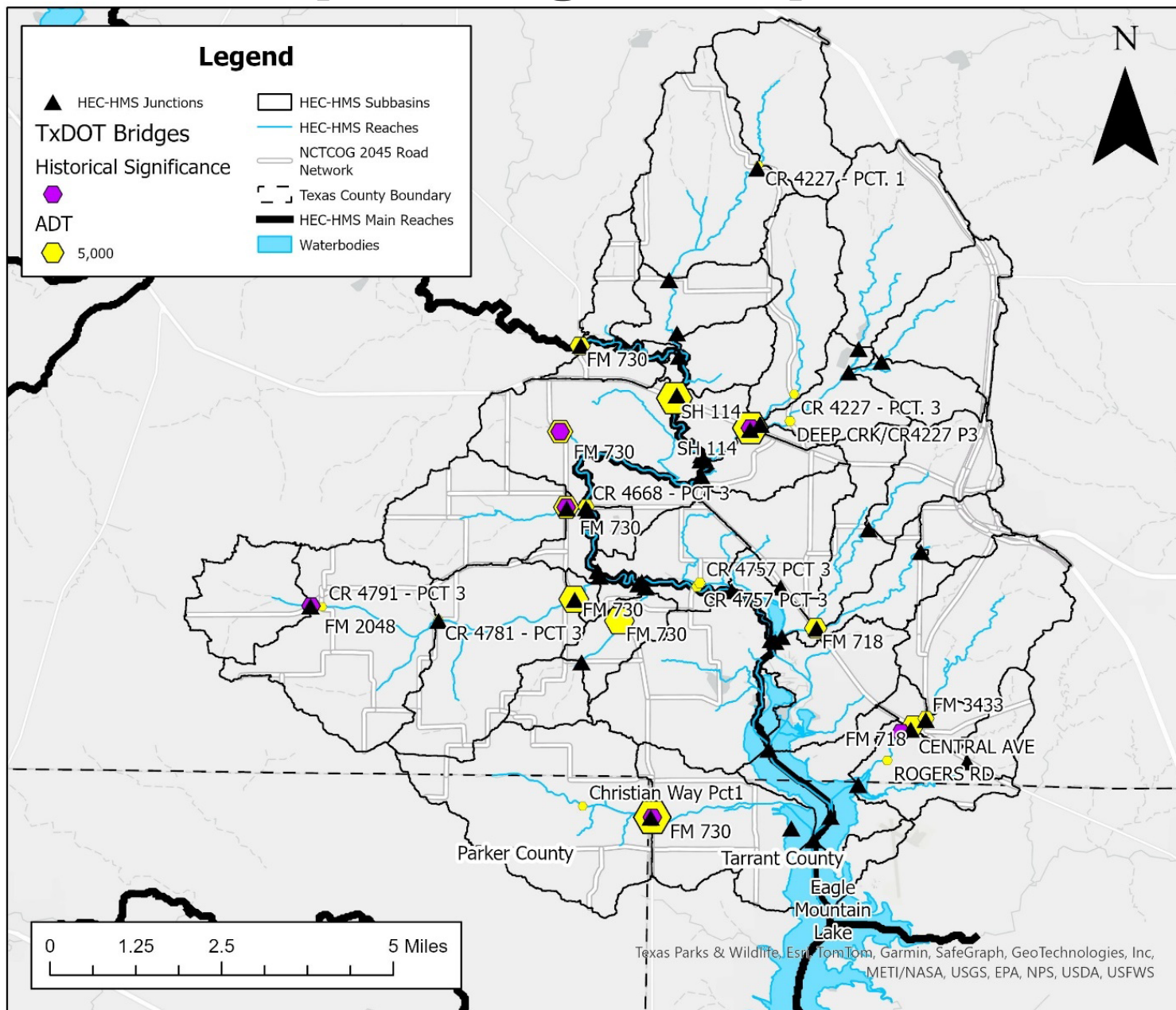
Sink Discharge (2070): **51,143** cfs

Theoretical Storage Required = **6,211** Ac-ft



# TSI Optimization: Incorporating Transportation

- We are investigating methods to prioritize additional junctions at which to restrict flow by utilizing transportation data, such as bridge and culvert data from TxDOT.
- An example of two attributes (historical significance and average daily traffic, ADT) is shown.



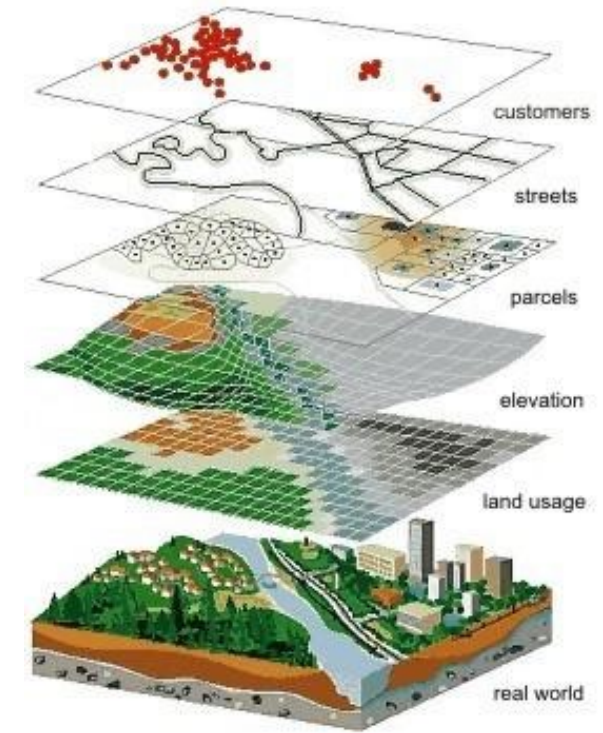
# Technical Topics

Stacking Model Update

# 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

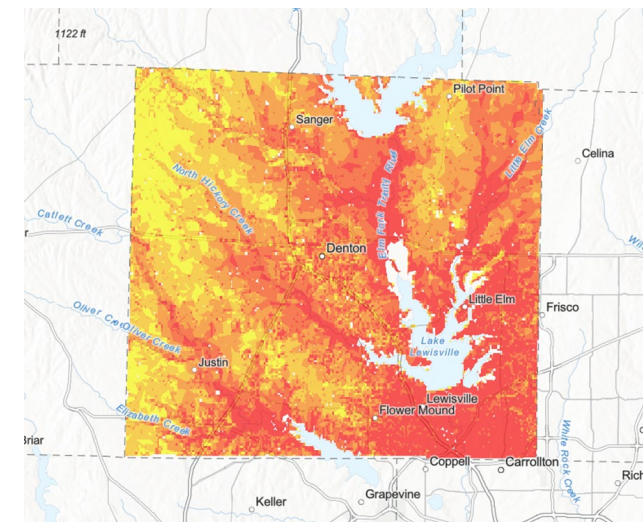
- Social vulnerability index
- Population density

### 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

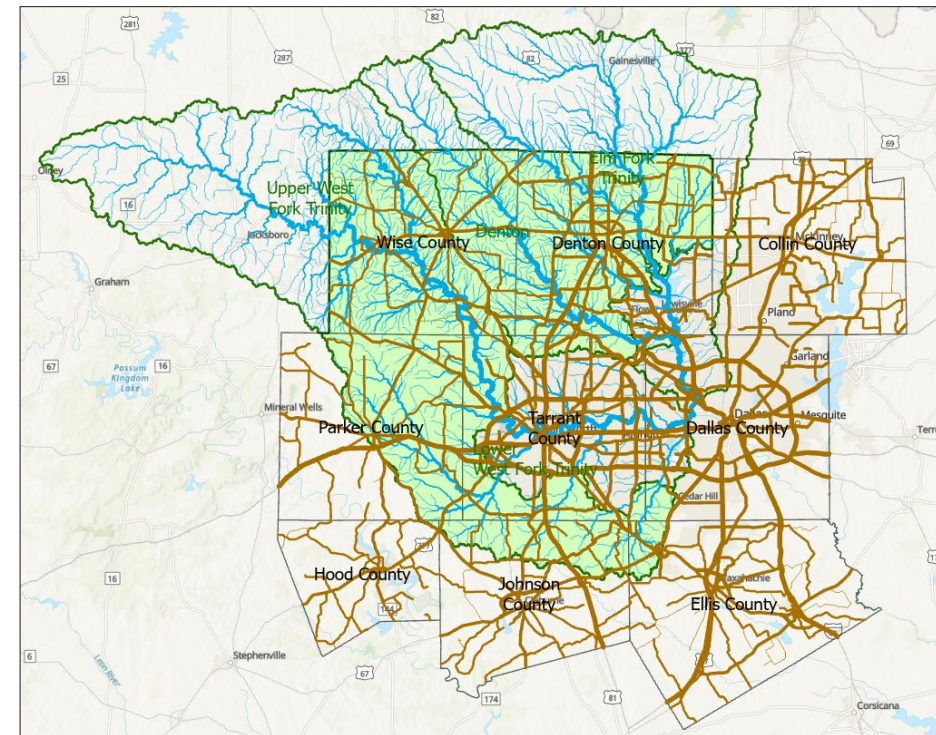


# Technical Topics

Flood Warning System Coordination

# Flood Warning System Coordination

- General approach for TSI:
  - Evaluate the latest methods and state-of-the-art technology that could enhance existing (or complement ongoing development of) flood forecasting and warning system(s) in the TSI Project Area.
  - Investigate best practices for meteorological and hydrologic and hydraulic modeling systems.
  - To avoid duplication, the capabilities and opportunities to partner with or integrate information into existing regional flood warning platforms and tools will be evaluated.
- How are we accomplishing this?
  - Research existing flood warning system platforms
  - Discuss with key stakeholders (communities, organizations, subject matter experts, etc.)
  - Evaluate various approaches and systems
  - Document findings and make recommendations
- Some questions to answer:
  - Where's it going to flood and how much?
  - When will the flooding happen?
  - Is it going to impact critical infrastructure?
  - What's the plan for transportation routing and safety?



Gauge Overview	Current	Forecasted
	Rising: 0 Constant: 0 Falling: 0	0
	Rising: 0 Constant: 0 Falling: 0	0
	Rising: 0 Constant: 0 Falling: 0	0
	Rising: 0 Constant: 0 Falling: 0	0

## IOWA FLOOD INFORMATION SYSTEM

The IFIS is a one-stop web-platform to access community-based flood conditions, forecasts, visualizations, inundation maps and flood-related information, visualizations and applications

**LAUNCH IFIS**

**IOWA** Iowa Flood Center

IFIS Widget | Video Guide | Text Alerts

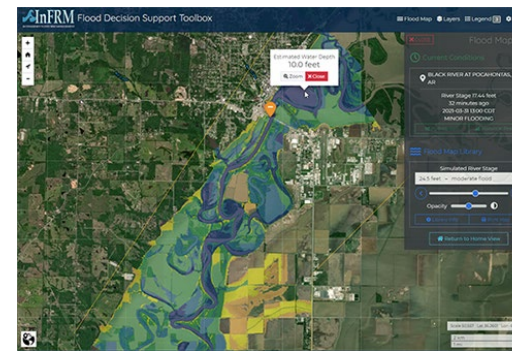
INUNDATION MAPS | FLOOD ALERTS | STREAM CONDITIONS | RIVER COMMUNITIES

ABOUT | FEATURES | TOOLS | RESOURCES

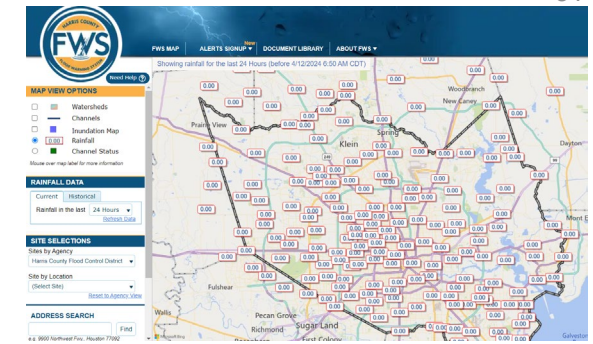
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# Flood Warning System Coordination

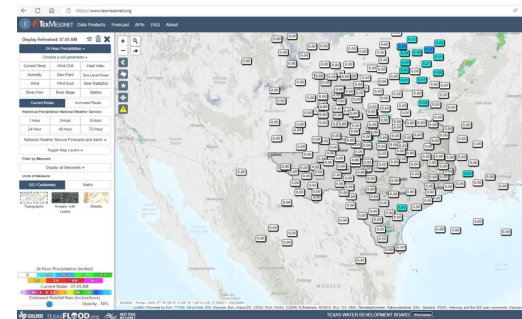
- The role of coordination on TSI
  - Federal coordination (FEMA, NWS, USGS, USACE, etc.)
    - Interagency Flood Risk Management (InFRM)
    - National Water Model (HAND vs. RAS2FIM)
    - Traditional USGS gaging
  - State coordination (TWDB, TxDOT, etc.)
    - TWDB Flood Organizing Group
    - TxDOT/UT-Austin exploring Road Elevation Model and stormwater infrastructure, including low water crossings, span bridges, and bridge-class culverts.
  - Local coordination (TSI community outreach meetings, exploration of existing platforms, water districts, etc.)
    - Low-cost gaging/sensor considerations
    - In-house vs outsourced monitoring
  - Other coordination (i.e., conferences, academia, consultants, etc.)



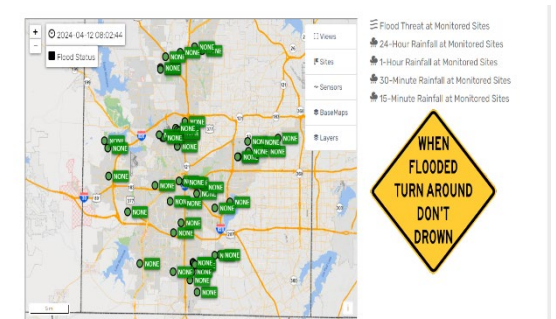
InFRM Flood Decision Support Toolbox  
<https://webapps.usgs.gov/infrm/fdst/>



Harris County Flood Warning System  
<https://www.harriscountyfws.org/>

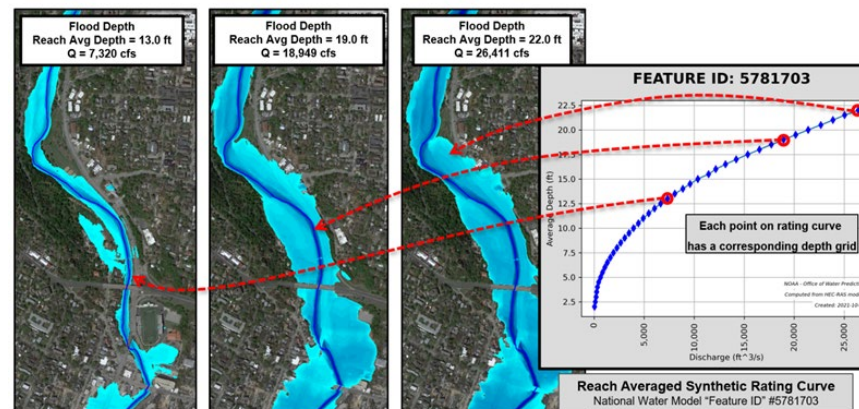
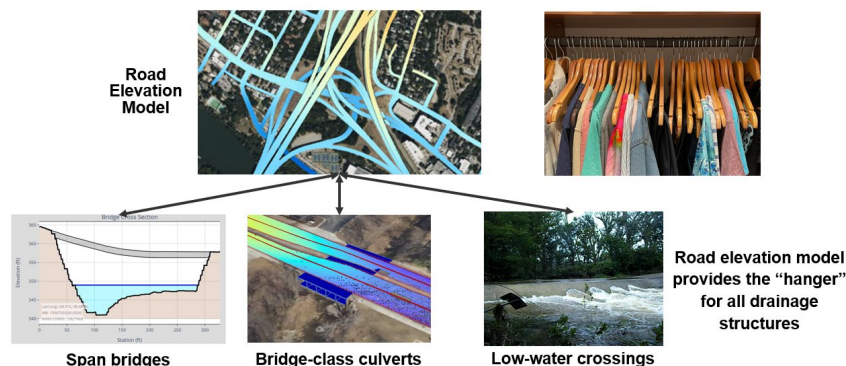


TWDB TexMesonet  
<https://www.texmesonet.org/>

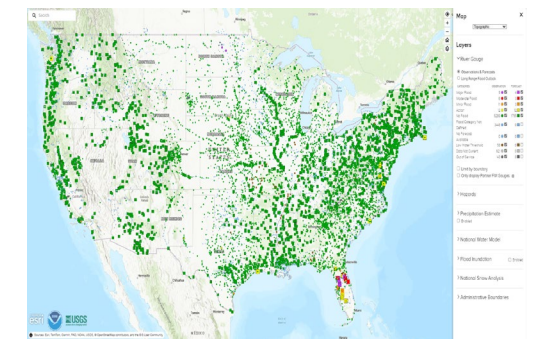


Fort Worth OneRain Flood Warning  
<https://www.texmesonet.org/>

## Road Elevation Model Links to Stormwater Infrastructure



RAS2FIM: (Flood Inundation Mapping (FIM) geospatial grids from Hydrologic Engineering Center - River Analysis System (HEC-RAS) models



National Water Model  
<https://water.noaa.gov/map>

# Real-Time Road Flood Inundation Mapping



water surface elevation



road elevation



road flooding





# Technical Topics

Flooded Roads Information Systems Project

# Flooded Roads Information System Project

- Improve roadway safety by providing advance warnings to drivers/vehicles through mobile driving apps and connected vehicle systems
- Systems will focus on alerting users of a high probability of water pooling, ponding, or flooding on roadway surfaces
- Includes integration with existing regional flood detection systems and a needs assessment for locating additional rain sensing infrastructure
- Includes incorporation of data/outputs resulting from emerging practices in meteorological, hydrologic, & hydraulic modeling systems (TSI Study)

Implementing Agency	City	Limits	Fiscal Year	Federal Surface Transportation Block Grant (STBG) Funds – Category 7	Transportation Development Credits (TDCs)
NCTCOG	Various	Regionwide	2025	\$2,000,000	\$400,000; TDCs to be utilized in lieu of a cash match

# Upcoming Events

And Contact Information

# Upcoming Events

## Floodplain Seminar for Elected Officials

November 1, 9:30-11:30 AM

NCTCOG Offices, Transportation Council Room, 616 Six Flags Drive, Arlington, TX 76011

Registration: <https://www.addevent.com/event/Eb22200441>

# Contact



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