North Central Texas Council of Governments

Integrating Transportation and Stormwater Infrastructure for Resilient Growth in North Texas

NCTCOG 27th Annual Public Works Roundup
August 20, 2026 – Hurst, TX

Presented by:

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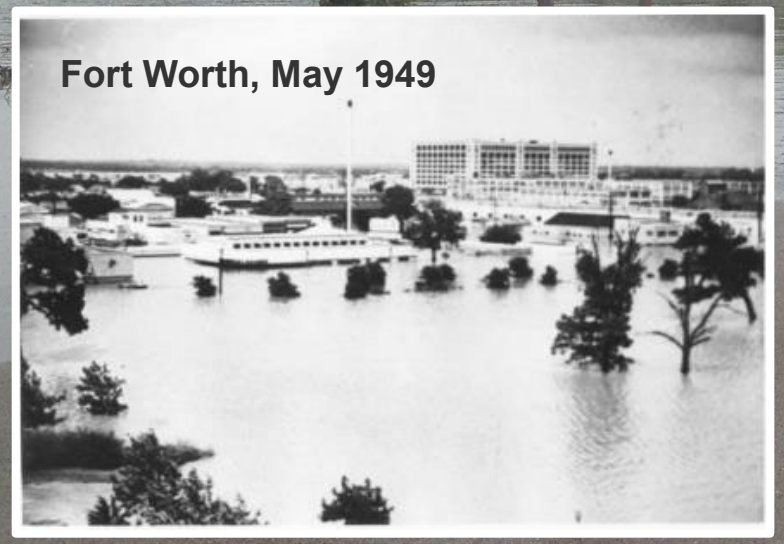
Funded by the Texas General Land Office, Community Development Block Grant, Disaster Recovery Program.

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

Historic events led to improvements in flood control infrastructure during the last century. New needs are developing in this century…



Rhome, May 2015
Courtesy: Tarrant Regional Water District (TRWD)

TSI Study Objectives

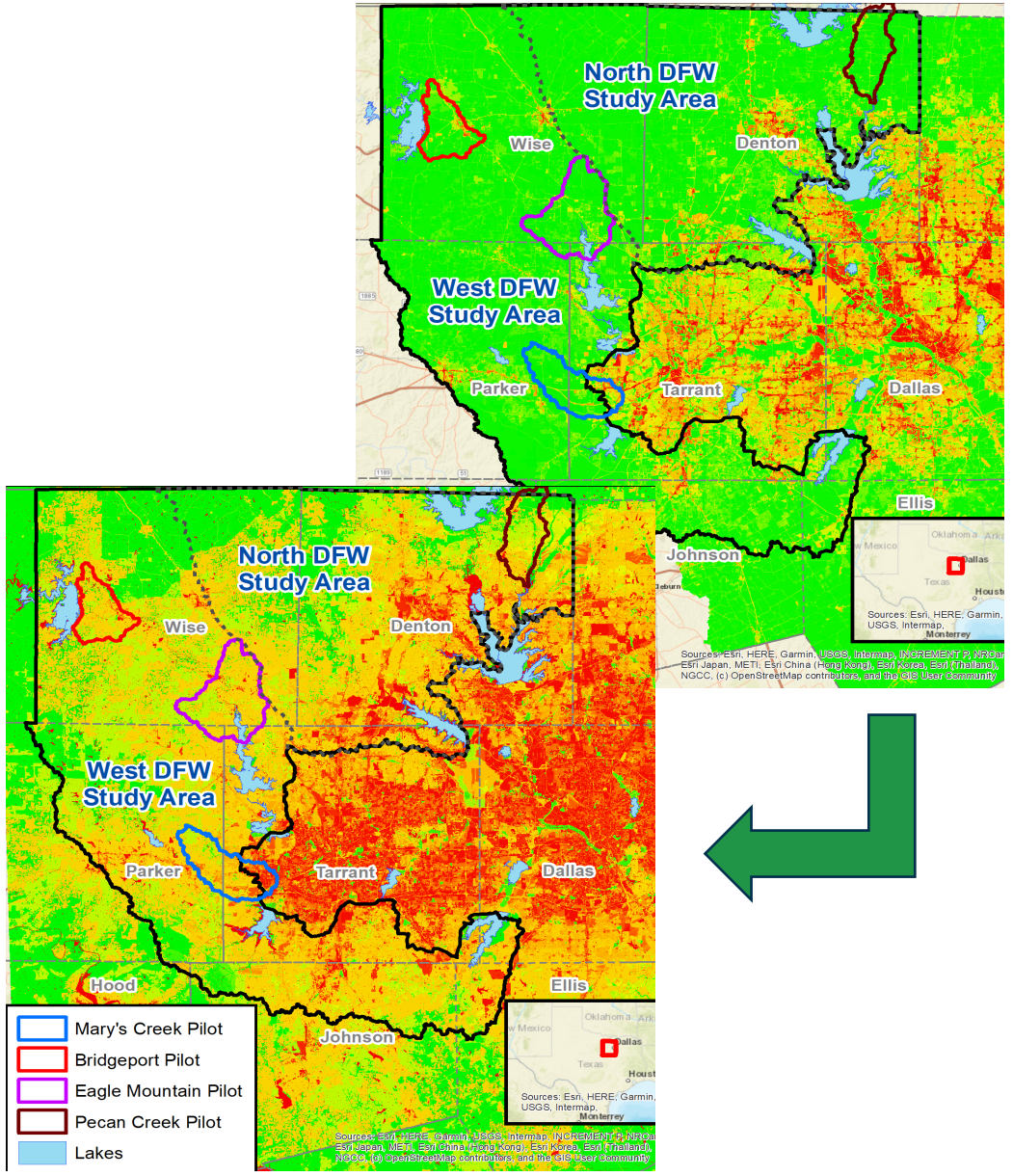
$10+ million comprehensive planning study

- Proactive planning
- Stormwater, environmental, and transportation infrastructure integration
- Safety of residents, property, and infrastructure
- State-of-the-art flood hazard area models
- Flood warning system framework
- Innovative infrastructure, nature-based solutions, and regulatory approach resources
- Tools, literature, and data

Expected completion:

- **Fall 2026**

6.4% Impervious (2020)



35.2% Impervious (2070)

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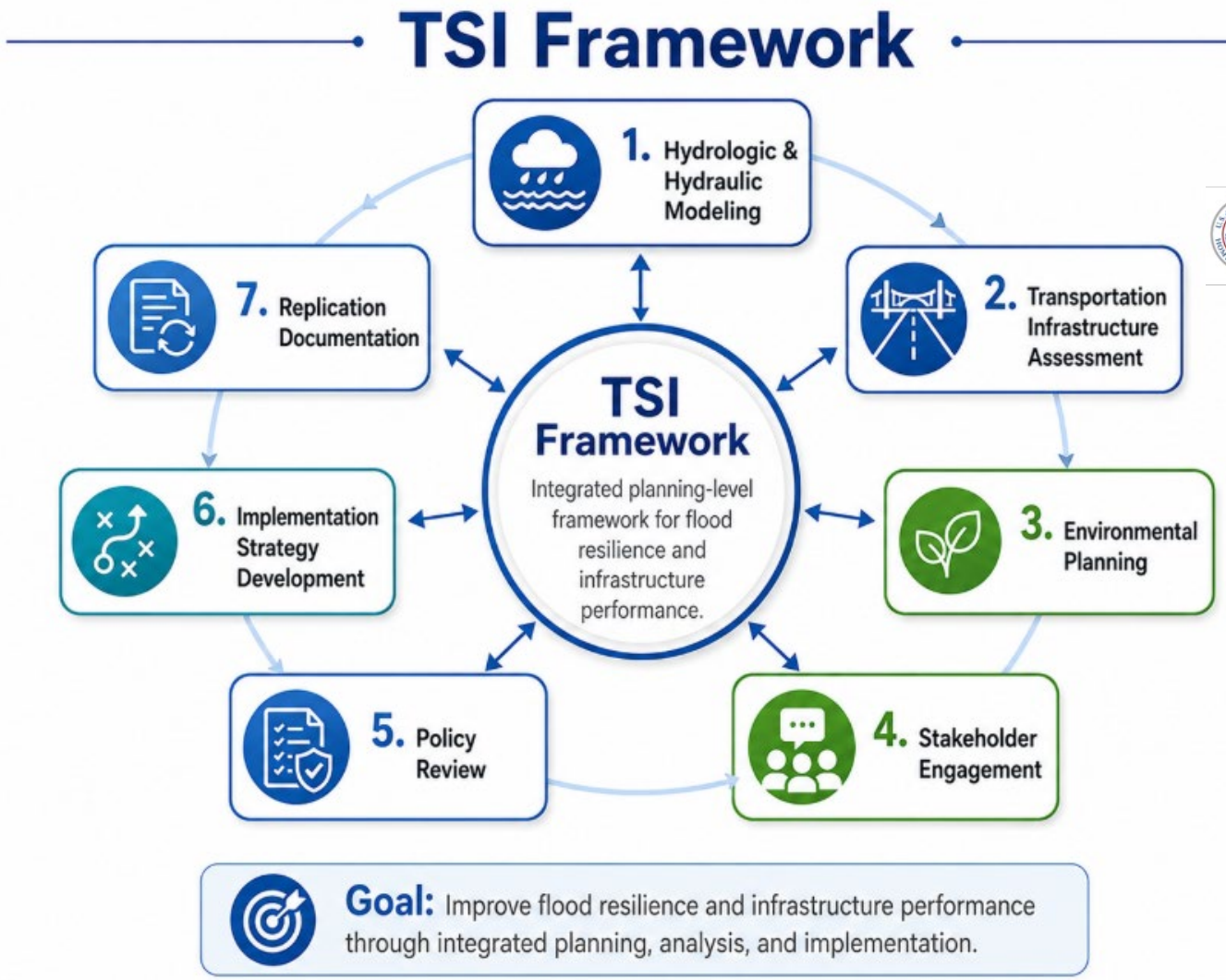
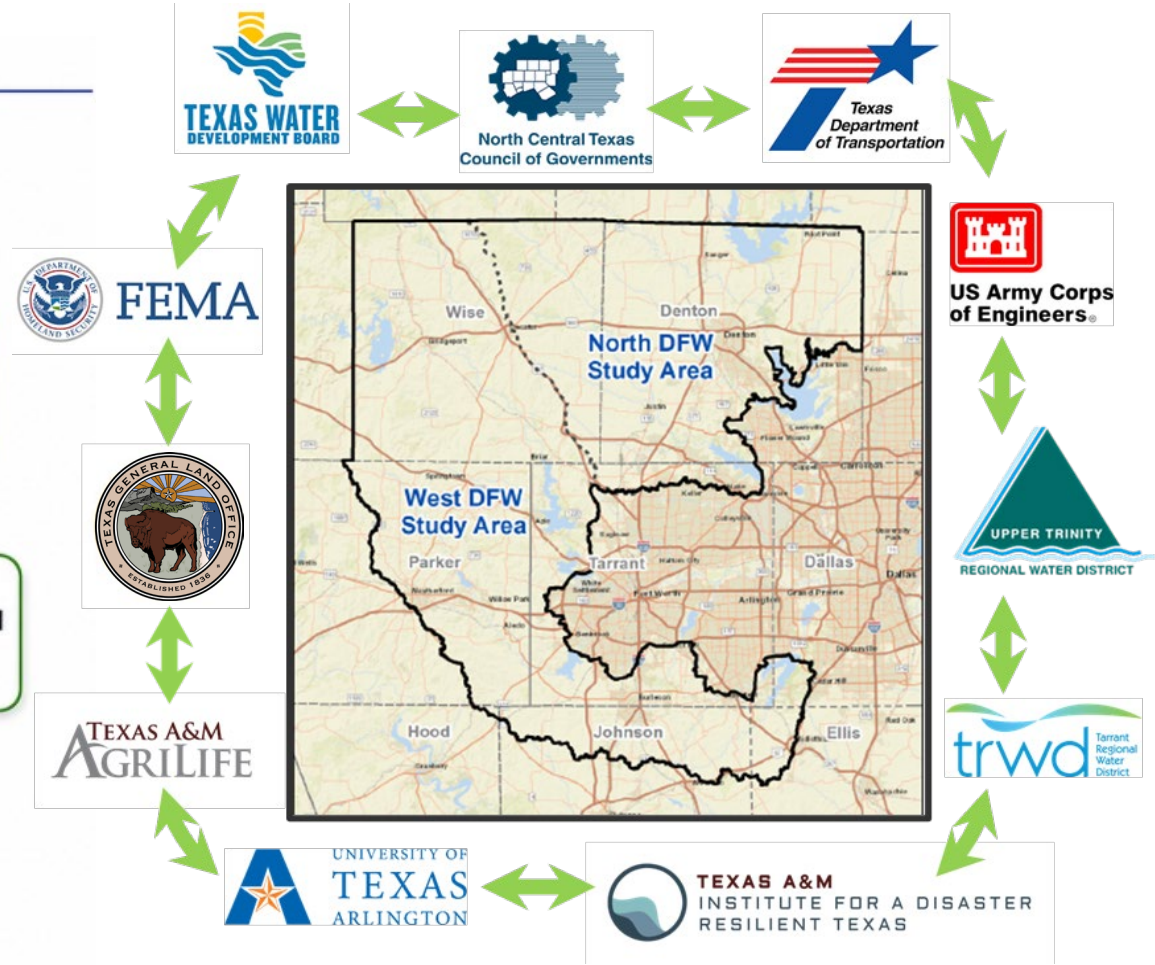
TSI Overview & Study Partners





Consultant Partners:

- Freese and Nichols, Inc.
- Halff Associates, Inc.
- Highland Economics

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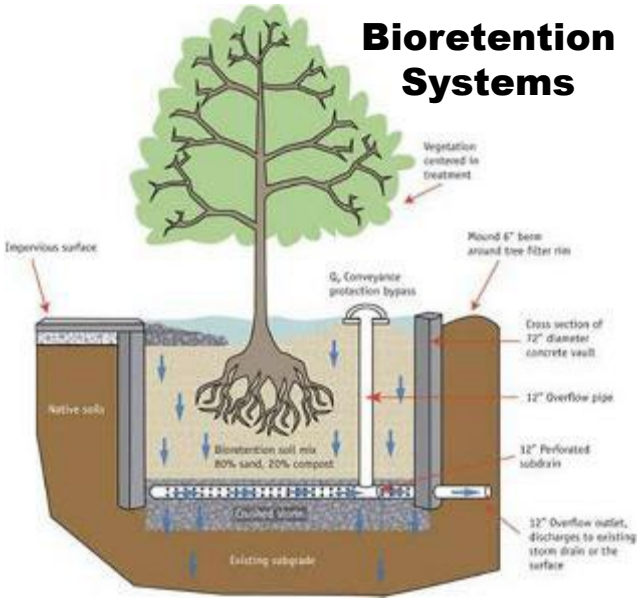
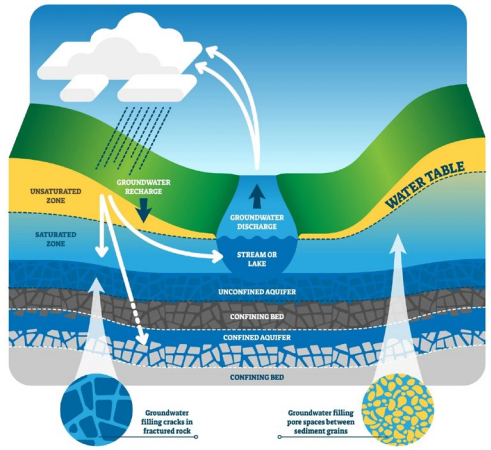
TSI Integration – Menu of Options to Address Flooding

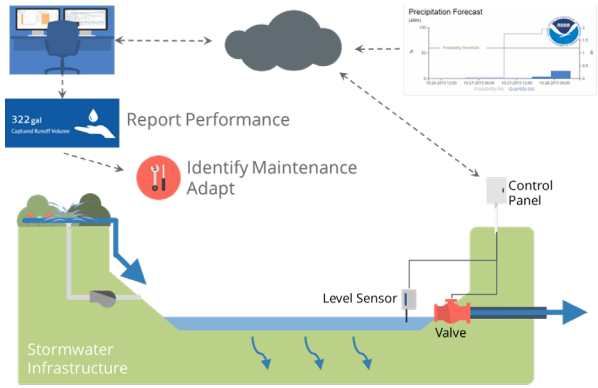
Bioretention Systems



Groundwater Recharge/Reuse



Smart Stormwater Infrastructure



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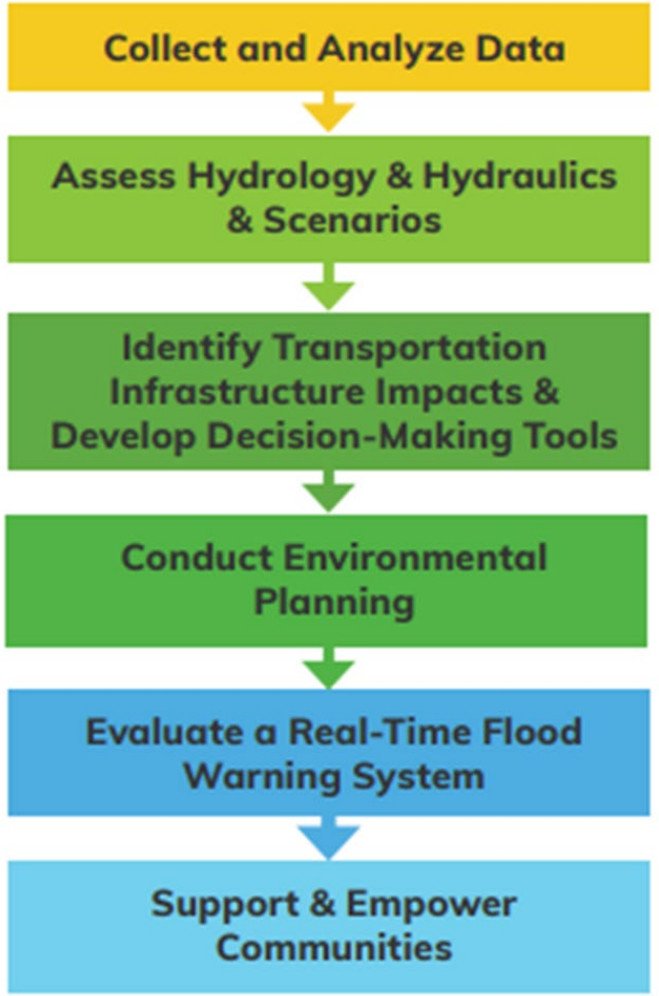
Menu of Options – Categories

- Hydrology and Hydraulic (H&H) Modeling Enhancements
- Flood Control and Green Stormwater Infrastructure (GSI)/Nature-Based Solutions (NBS) Prioritization
- Alternatives Analysis
  - Optimization Process
  - Detailed Projects
  - No Action Evaluation
- Flood Early Warning Systems (FEWS) Planning
- Funding Opportunities
- Policy Recommendations

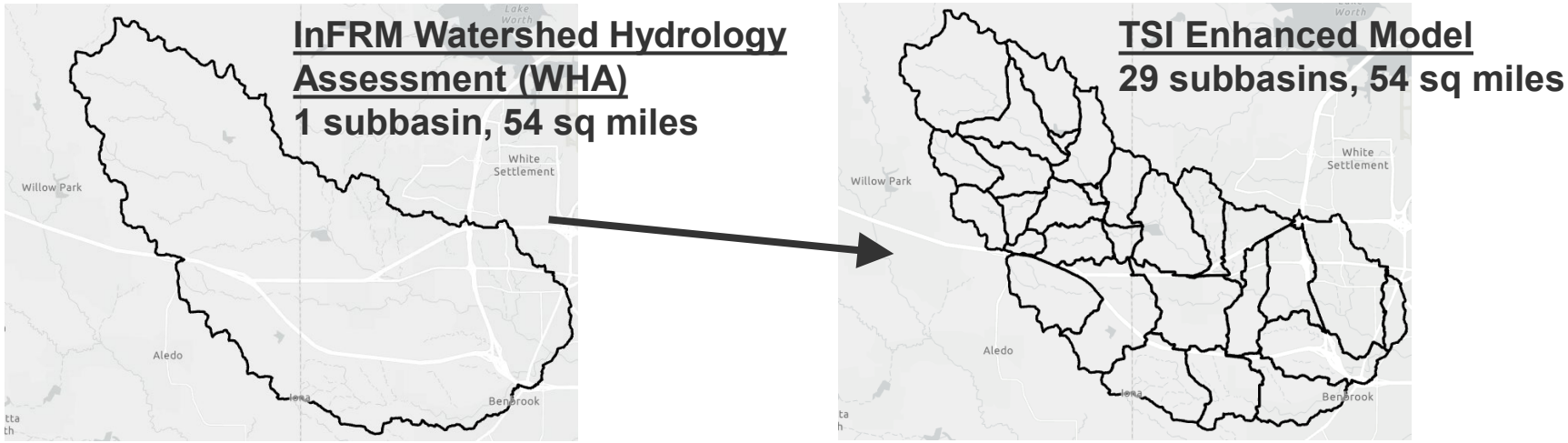


Menu of Options: H&H Model Enhancements

Available H&H datasets are being leveraged and enhanced

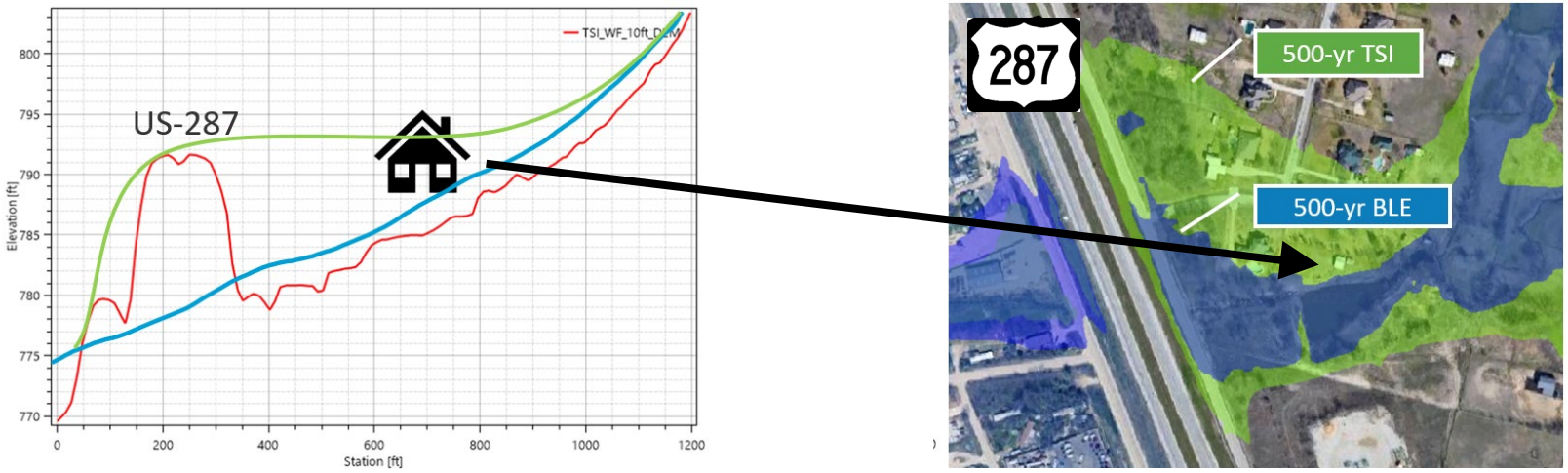
Hydrology Enhancements:

- Additional subbasins
- Future land use (2070)
- Future valley storage



Hydraulic Enhancements:

- Adding TxDOT bridges
- Future discharges
- Other enhancements



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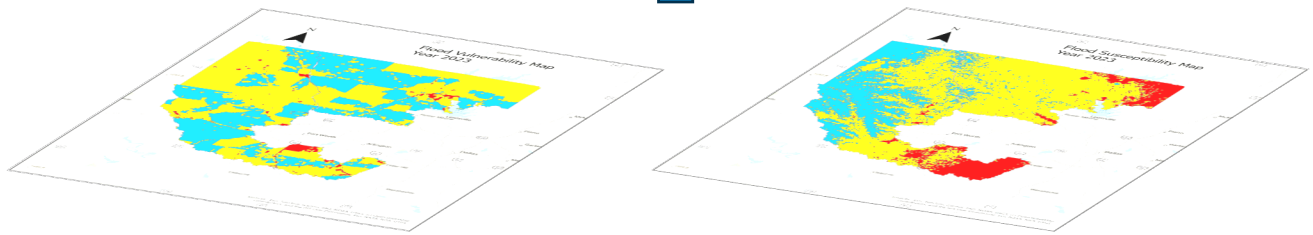
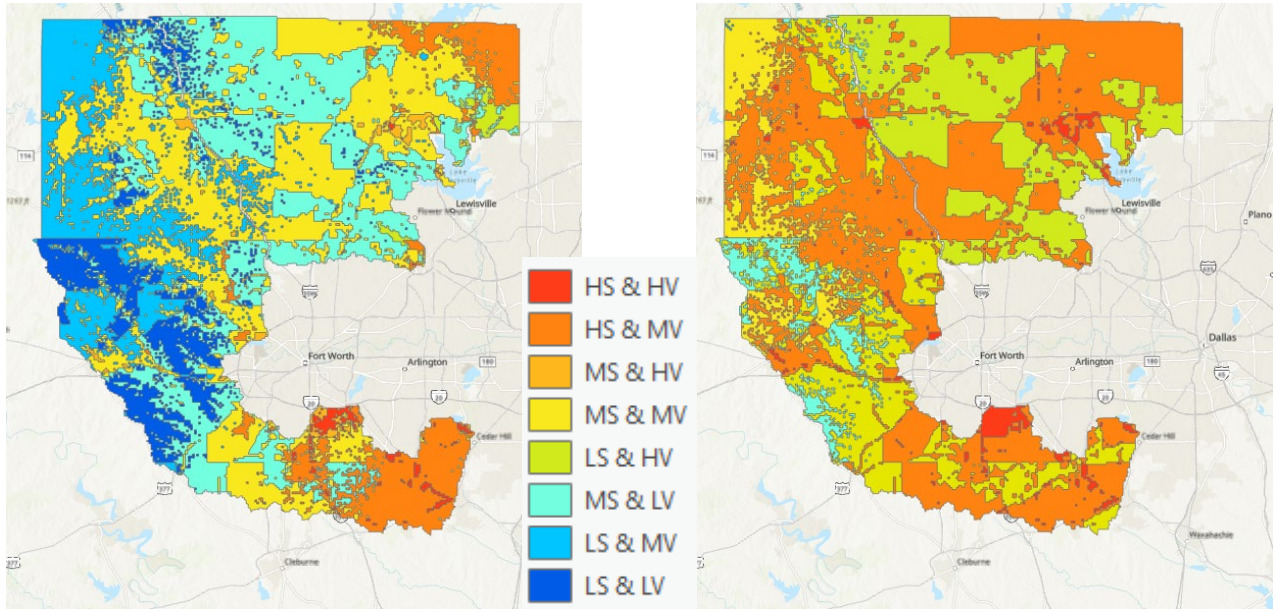
Menu of Options: Flood Control & GSI/NBS Prioritization

- **Includes four condition factor categories** *(social, environmental, institutional, and transportation)*
- **Aids development of a GSI/NBS suitability index for flood mitigation:**
  - Which areas should be prioritized for GSI/NBS to reduce regional flood risk?
  - How can GSI/NBS be designed/modeled to achieve a target performance?
  - What is the efficiency of applying GSI/NBS at a watershed or community scale?

Flood Vulnerability Map + Flood Susceptibility Map



Flood Control Prioritization Map



2023 2045

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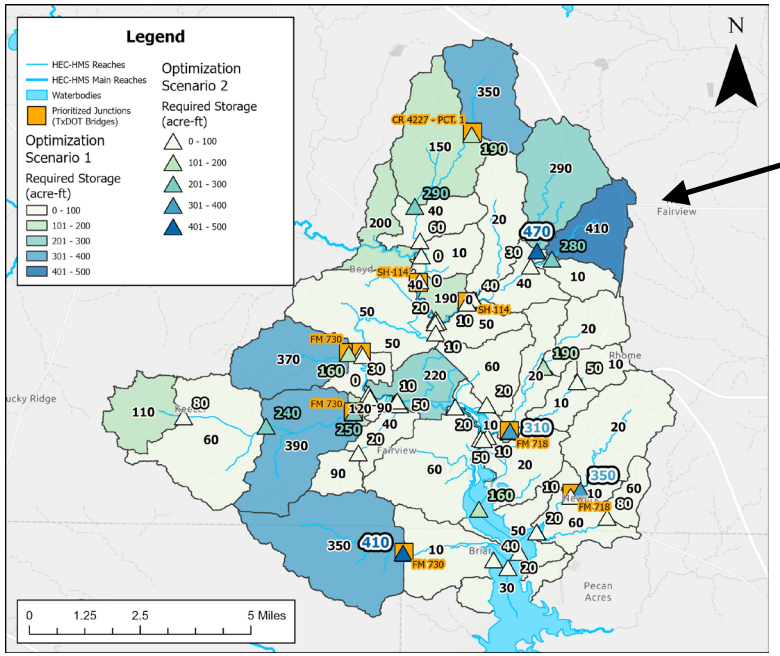
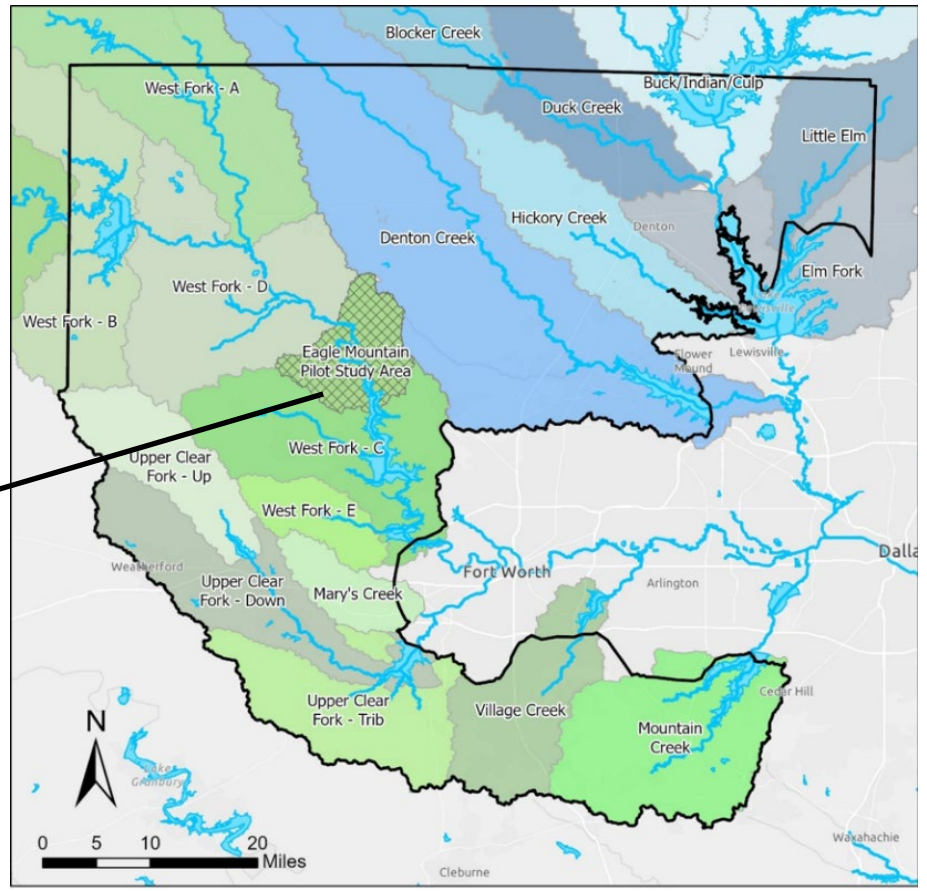
Menu of Options: Alternative Analysis – Optimization

Identify optimal storage volumes at specific locations to mitigate future peak discharge increases, based on estimated 2020-2070 land use change effects on impervious cover and valley storage loss

- Scenario 1
  - **Subbasin** *(local)*
- Scenario 2
  - **Junction** *(regional)*





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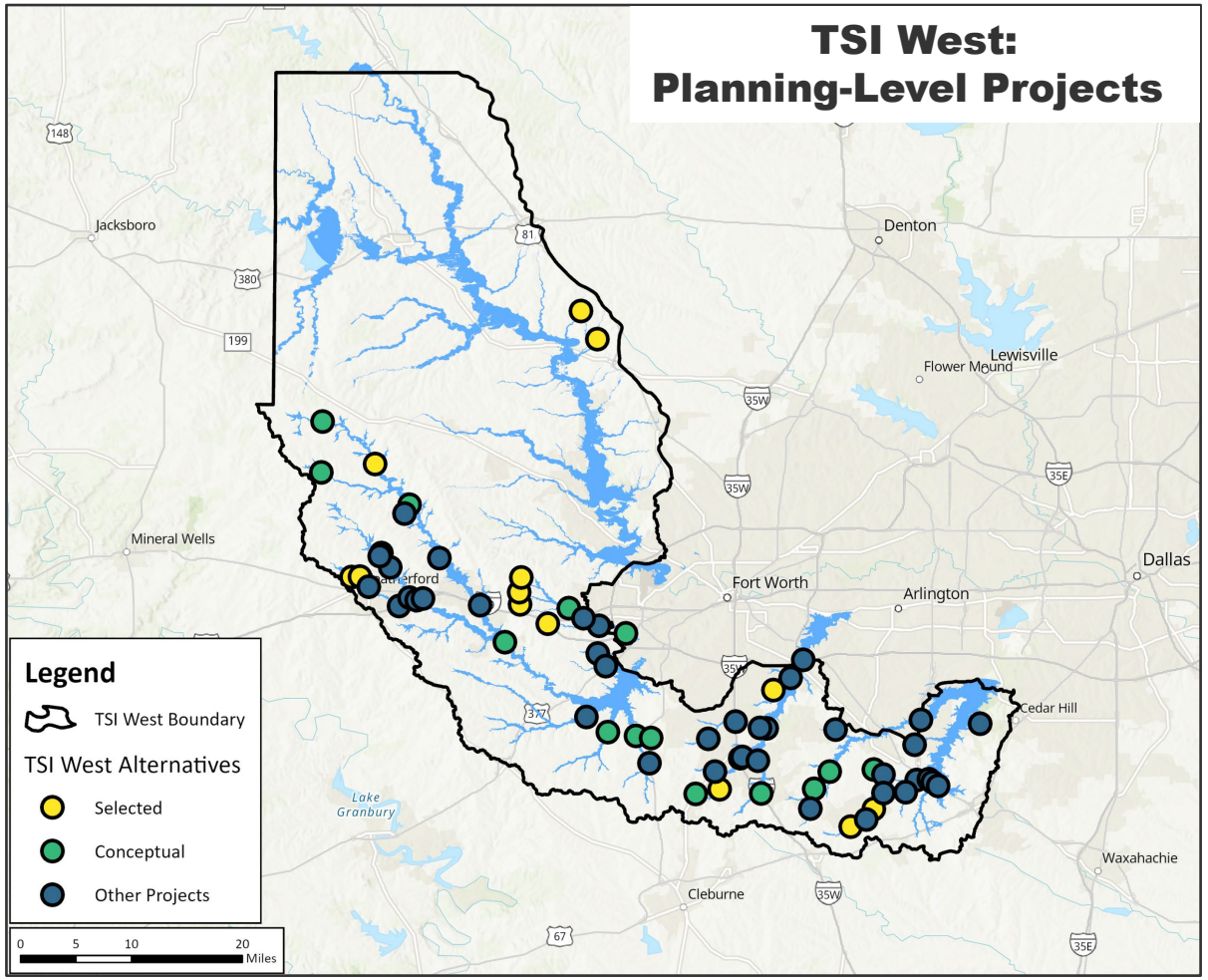
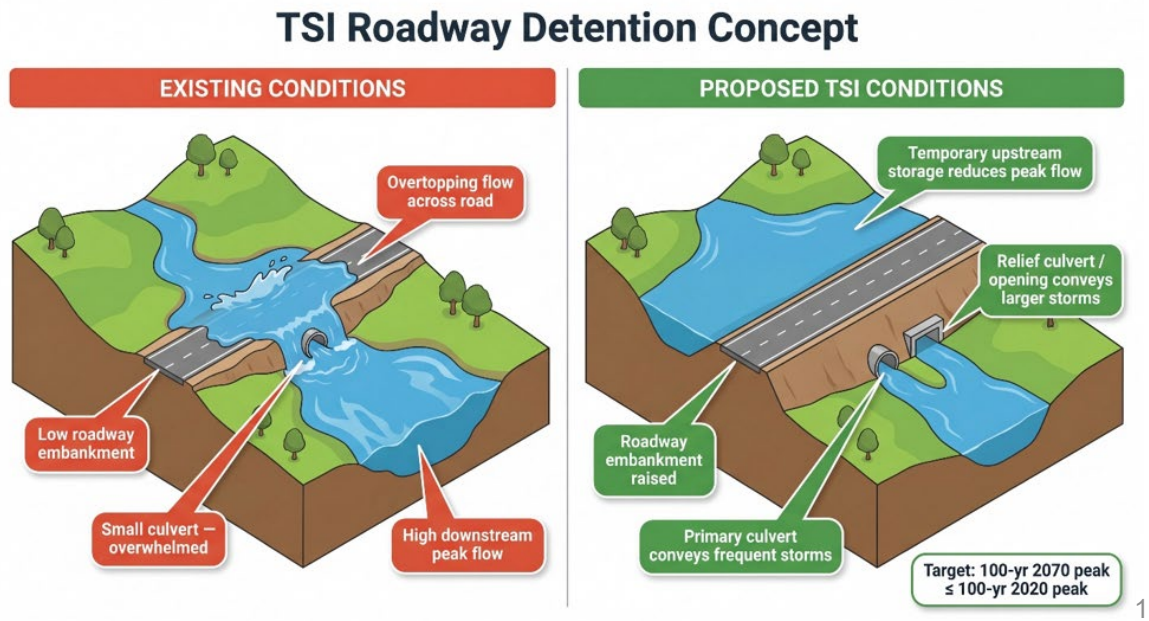
Detailed Projects



Watershed / Modeling Area	Alternative Locations	General Types of Locations Represented
Eagle Mountain / Lake Worth *(LAWO)*	24	Road crossings of Blue Creek, Deep Creek, Watson Creek, West Fork, & other tributaries
Upper Clear Fork Trinity River *(UCFT)*	24	Road crossings of Clear Fork, Rock Creek, Town Creek, Willow Creek, & other tributaries
West Fork Trinity River *(WEST)*	7	Flood-prone locations & road crossings of Silver Creek, West Fork, & other tributaries
Mary's Creek *(MARY)*	9	Road crossings of Mary's Creek & tributaries, road exposure points, & buyout opportunities
Village Creek *(VICR)*	14	Road crossings of Chambers Creek, Deer Creek, Quil Miller Creek, Village Creek, & other tributaries
Mountain Creek / Joe Pool Lake *(JOPL)*	18	Flood-prone locations & road crossings of Mountain Creek, Walnut Creek, & other tributaries
TOTAL	**96**	**TSI West – Planning-level Alternatives & Project Locations**



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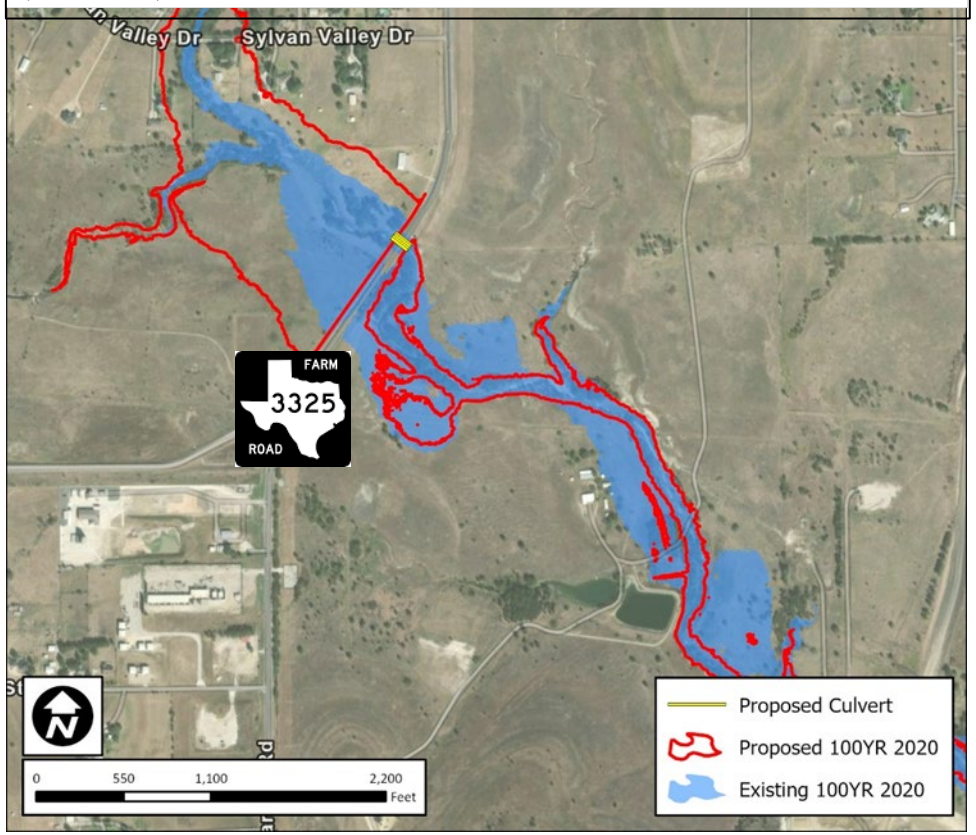
Detailed Project Example – FM 3325 @ Mary's Creek

PROJECT NAME	TSI ADDED COST *(New Detention & Flow Cuts)*	BUYOUT COST *(Induced Flooding to Properties / Structures)*	TOTAL ADDED COST	MODELED FLOOD DAMAGE REDUCTION *(Present Value)*	BENEFIT COST RATIO *(BCR)*
MARY'S CREEK WATERSHED					
FM 3325 @ Mary's Creek	$2,200,000	$1,600,000	$3,800,000	$14,300,000	**3.8**

	100-year 2020 Flows		100-year 2070 Flows	
	Existing	Proposed	Existing	Proposed
Peak downstream flow* (cfs)	13,200	8,100	14,100	8,300
Peak headwater* (ft)	919.2	925.4	920.3	925.4
Max depth over roadway* (ft)	1.9	-	2.1	-
Added storage* (ac-ft)	-	237	-	238

*Rounded values

	Existing	Proposed
Crossing	110' Span Bridge	4 - 10'x10' RCBs @ 902.5'
Minimum road elevation (ft)	911.1	927.8
Level of Service (2020 Flows)	2-year	100-year



Project Details:

- Mobility 2050 – Capacity increase from 2-lane rural to 4/6-lane urban divided
- Raise roadway nearly 17 feet for an approximate length of 1,500 feet
- Replace current bridge with multi-barrel culvert system
- Conveyance improves from 2-year to 100-year flood event *(under 2020 flows)*

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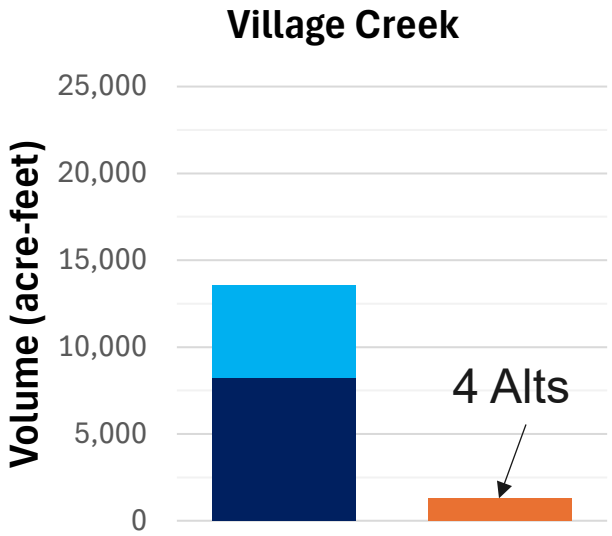
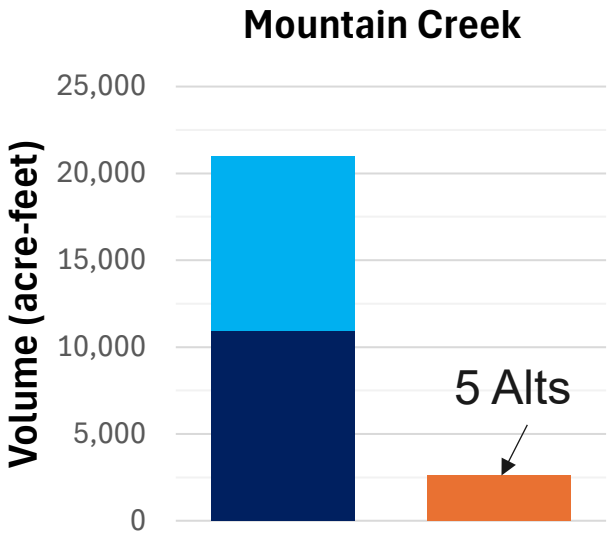
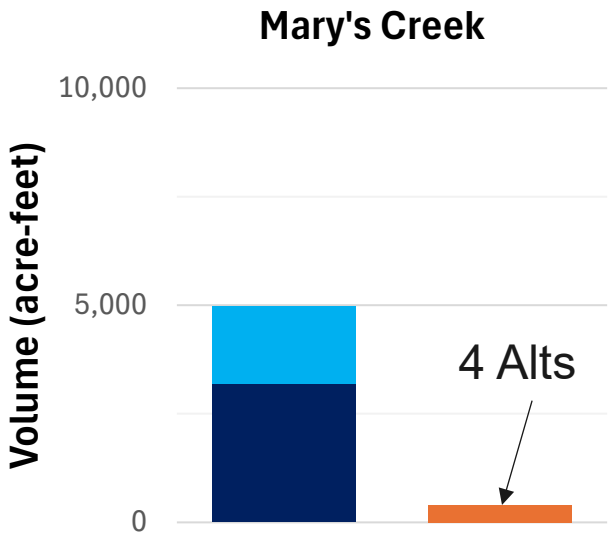
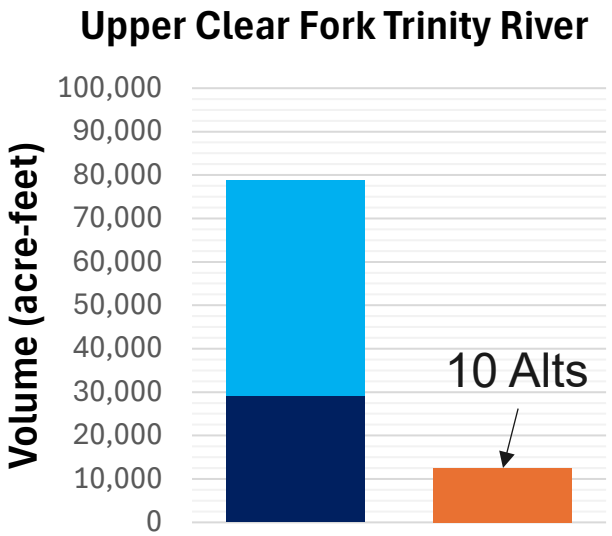
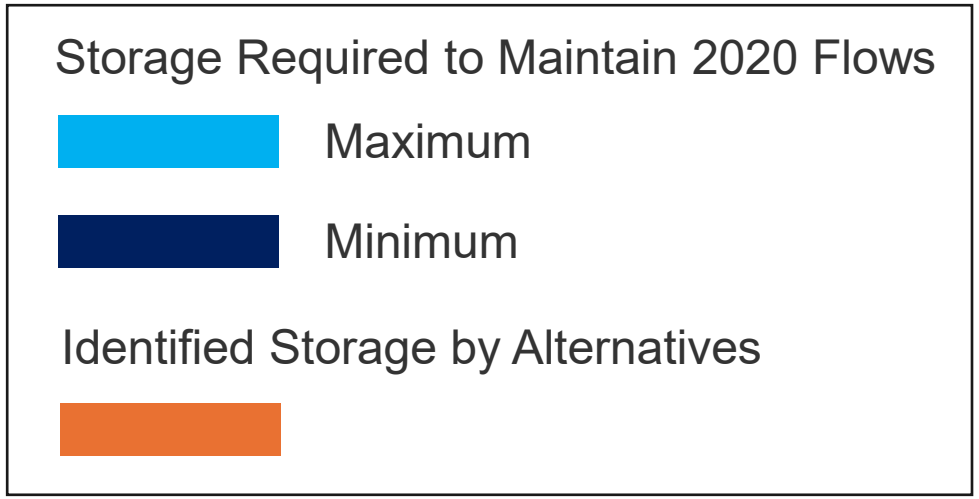
Storage Results – TSI West











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Watershed Storage Using Transportation Detention

STORAGE GOAL – REDUCE 2070 FLOW TO 2020 LEVELS					TOTAL	
Watershed / Study Area	Theoretical Storage Required *(acre-ft)*	Scenario #1: Local Storage *(acre-ft)*	Scenario #2: Regional Storage *(acre-ft)*	Watershed Unit Cost *(acre-ft)*	**Cost Range**	**Number of Projects**
Village Creek	13,540	9,350	8,210	$69,000	**$500M – $1B**	**25 – 40**
Mountain Creek	21,000	12,710	10,970	$71,000	**$750M – $1.5B**	**21 – 40**
Mary's Creek	4,990	3,200	3,300	$77,000	**$250M – $385M**	**28 – 45**
Upper Clear Fork Trinity River	78,900	41,470	29,970	$16,760	**$500M – $1.3B**	**23 – 63**

KEY FINDINGS:

- Loss of valley storage significantly increases future flood risk. Simply managing new development runoff may be insufficient if floodplain storage is reduced over time.
- TSI roadway detention concept should be pursued, though embankments will be far more cost-effective than excavation.
- With limited locations & high costs for detention in urbanized areas, confining fill to outside of the flood or requiring valley storage impact mitigation, will provide greater flood protection.

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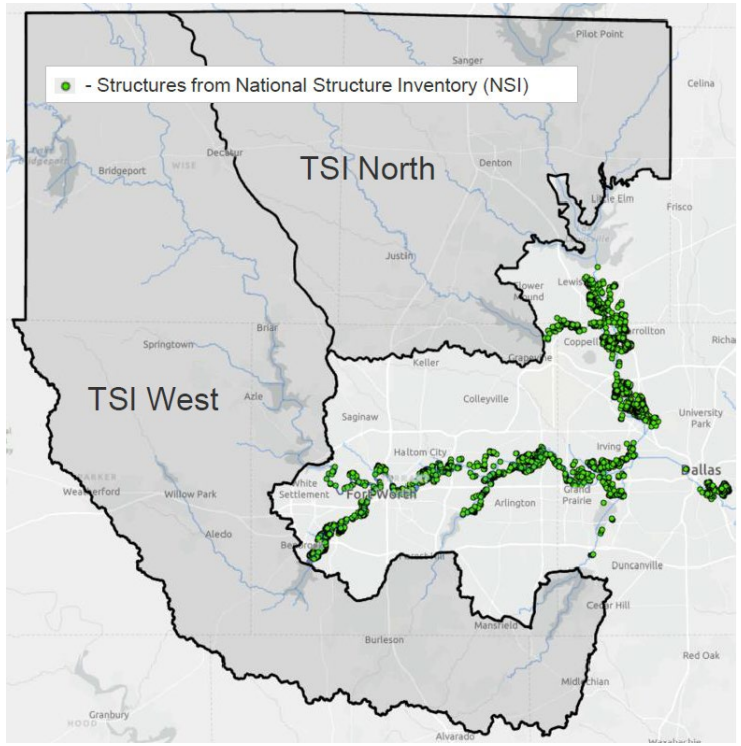

No Action – Increased Damage

YEAR	TSI WEST SUBAREA DAMAGE – BY WATERSHED					TOTAL
	Lake Worth	Village Creek	Mary's Creek	Upper Clear Fork Trinity	Mountain Creek	TSI WEST *(Modeled)*
2020	$0	$0	$0	$0	$0	$0
2027	$1.0M	$2.1M	$0.4M	$3.4M	$0.5M	$7.4M
2050	$4.6M	$10.0M	$2.2M	$21.3M	$2.8M	$40.9M
2070	$11.4M	$25.9M	$6.7M	$102.0M	$11.1M	$157.1M
2076	$16.2M	$38.1M	$10.3M	$183.7M	$18.9M	$267.2M
Avg. Annualized Damage *(2027-2076)*	$4.5M	$9.9M	$2.3M	$28.1M	$3.3M	$48.1M
Present Value Damage *(2027-2076)*	**$110.7M**	**$244.1M**	**$57.3M**	**$690.2M**	**$81.6M**	**$1.18B**

YEAR	DOWNSTREAM DAMAGE – BY WATERSHED (500-Year Storm)					TOTAL
	Lake Worth	Village Creek	Mary's Creek	Upper Clear Fork Trinity	Mountain Creek	TSI WEST *(Modeled)*
Increased 500-Year Damage *(2020 vs. 2070)*	**$0**	**Pending**	**$198M**	**$25.3M**	**$0.1M**	**$261.5M**
Increased Annual 500-Year Damage *(2070)*	$0	Pending	$0.4M	$0.1M	$0	$0.5M

KEY FINDINGS (500-Year Storm):

- In TSI West, 400 more homes inundated without valley storage preservation
- Increased flood depths (≥ 1 ft) for nearly 900 existing homes in vulnerable Mary's Creek & Upper Clear Fork areas
- Over 10,000 downstream structures potentially impacted by TSI Study Area valley storage loss

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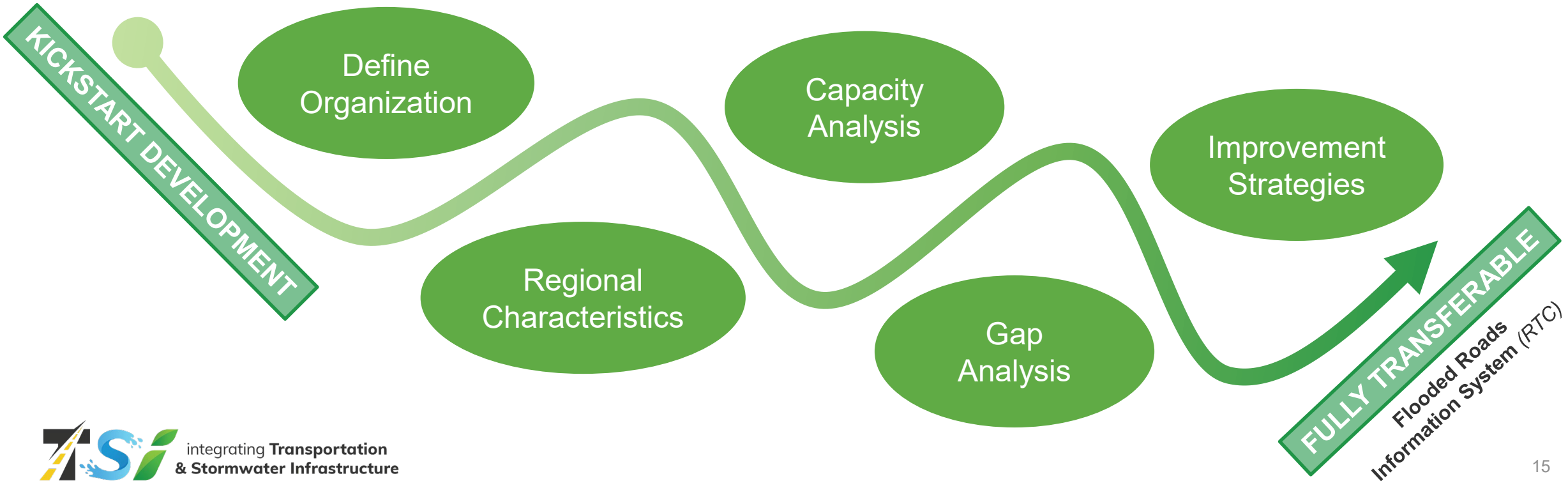
Menu of Options: Flood Early Warning System (FEWS)



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Menu of Options: Funding Opportunities

- Downloadable Excel Spreadsheet
- FAQ

- Identifies funding opportunities to support implementation of TSI strategy recommendations

Topics include:

- Flood Hazard Mitigation
- Water and Stormwater Infrastructure
- Watershed Protection and GSI/NBS Applications

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TSI integrating Transportation & Stormwater Infrastructure

TSI FUNDING OPPORTUNITIES TABLE – FREQUENTLY ASKED QUESTIONS

Menu of Options: Policy Recommendations

Higher Floodplain Strategies (examples):

- Require development setbacks
- **Preserve valley storage**

Built Environment Strategies (examples):

- Reduced streets in floodplains
- Reduced impervious cover

Comprehensive regional inventory within final report

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Preserve Valley Storage – Existing Higher Standards

CATEGORY	TYPE	SAMPLE CODES	DESCRIPTION
Freeboard Requirements	*Fixed Freeboard Above Base Flood Elevation (BFE)*	**Aurora, TX:** Flood Danage Prevention Ordinance	Establishes a two-foot (2') freeboard requirement above FEMA minimum standards.
		Johnson County, TX: Flood Damage Prevention Ordinance	Establishes a three-foot (3') freeboard requirement above FEMA minimum standards.
	Fully Developed Conditions Freeboard	**Denton, TX:** Development Code	Incorporates fully developed watershed conditions into freeboard requirements to account for future flood risk.
		Mansfield, TX: Flood Damage Prevention Ordinance	Incorporates fully urbanized hydrology studies into minimum elevation standards to account for future development conditions.
	Dual-Criteria / Higher-of-Standard	**Fort Worth, TX:** Floodplain Provisions Ordinance	Applies the more restrictive of FEMA flood elevations & fully developed watershed conditions to determine minimum elevation standards.
Match Pre-Development Runoff	*Peak Discharge Matching*	**Denton, TX:** Stormwater Design Criteria Manual	Maintains pre-development peak discharge rates through on-site stormwater controls.
	Downstream Impact Evaluation	**Kennedale, TX:** Public Works Design Manual	Requires evaluation of downstream drainage systems to identify & mitigate development-related increases in flow velocity & erosion potential.
	On-Site Runoff Mitigation	**Denton, TX:** Stormwater Design Criteria Manual	Requires on-site stormwater controls to reduce downstream flood impacts & maintain existing drainage conditions.
Valley Storage Preservation	*No Net Loss Standards*	**Benbrook, TX:** Flood Hazard Protection Regulations	Preserves floodplain storage capacity by prohibiting valley storage reductions below BFE.
	Compensatory Storage	**Fort Worth, TX:** Floodplain Provisions Ordinance	Requires replacement of displaced floodplain storage to maintain existing valley storage capacity & reduce downstream flood risk.
No-Rise / No-Adverse Impact	*Flood Elevation Impact Standards*	**Wise County, TX:** Flood Damage Prevention Ordinance	Preserves existing flood elevations by prohibiting BFE increases resulting from development within special flood hazard areas.
	Hydraulic Performance Standards	**Flower Mound, TX:** Floodplain Regulations	Preserves hydraulic performance by prohibiting increases in floodwater velocities resulting from development within flood hazard areas.

How Does TSI Get Implemented?

TSI will…

- Leverage, enhance, and/or recommend expanding existing regulatory frameworks
- Identify and recommend TSI Flood Management Projects (FMPs), Flood Management Evaluations (FMEs), & Flood Management Strategies (FMSs)
- **Collaboratively** explore/promote other avenues to expand flood resiliency & improve funding/programming opportunities (State Flood Plan, Federal grants, etc.)
- Find solutions that provide more benefit values beyond what projects may cost

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StoryMap

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