North Central Texas Council of Governments

Optimization Priority & Silo-Busting Examples
Breakout Station #3 – Transportation

2025 TSI Study Subarea Meetings

Weatherford, TX
September 15, 2025

Burleson, TX
September 22, 2025

Decatur, TX
September 23, 2025

Flower Mound, TX
October 1, 2025

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.

TSI Optimization – Brief Overview
Objectives & Considerations

- **GOAL:** Limit future peak flows near those of current conditions to combat anticipated effects of increased imperviousness & loss of valley storage due to urbanization in the **TSI Study** area.
- Optimization process performed in conjunction with hydrologic & hydraulic *(H&H)* modeling to determine junction storage requirements, analyzed from grey *(traditional)*, green *(nature-based)*, & combined mitigation perspectives.
- Junction selection based on distributed detention approach rather than solely at watershed outlets:
  - Upstream junctions/reaches may still experience peak flows higher than those currently experienced for storms of equal frequency.
  - Flow limitations at every junction may be infeasible, expensive, or result in excessive storage.
- Transportation crossings *(bridges/culverts)* & approaches *(clear zones, embankments, etc.)* provide opportunities to meter flows, in addition to stream confluences.

***Source**: Tarrant Regional Water District (TRWD); Rhome (Wise County), May 2015.*

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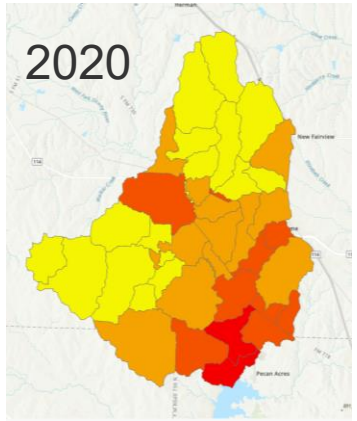
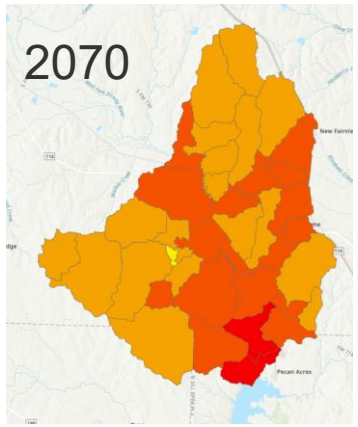
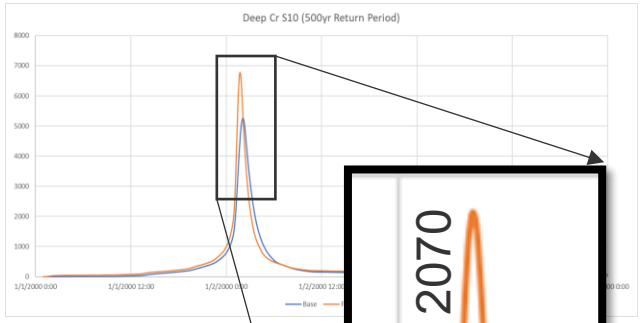
TSI Optimization – Brief Overview

Limiting Future Peak Flows – Junction Selection Process

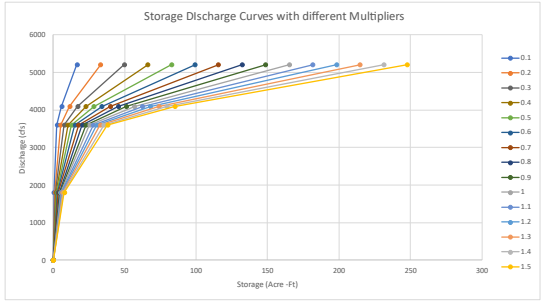


Increased Imperviousness





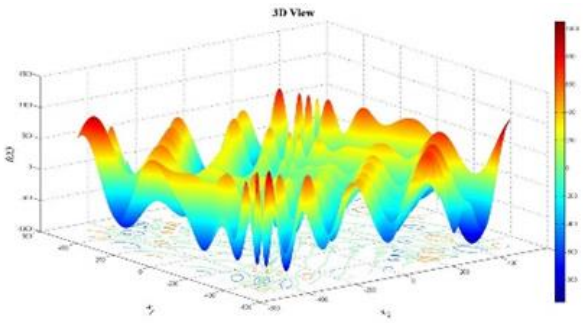
Increased Flow



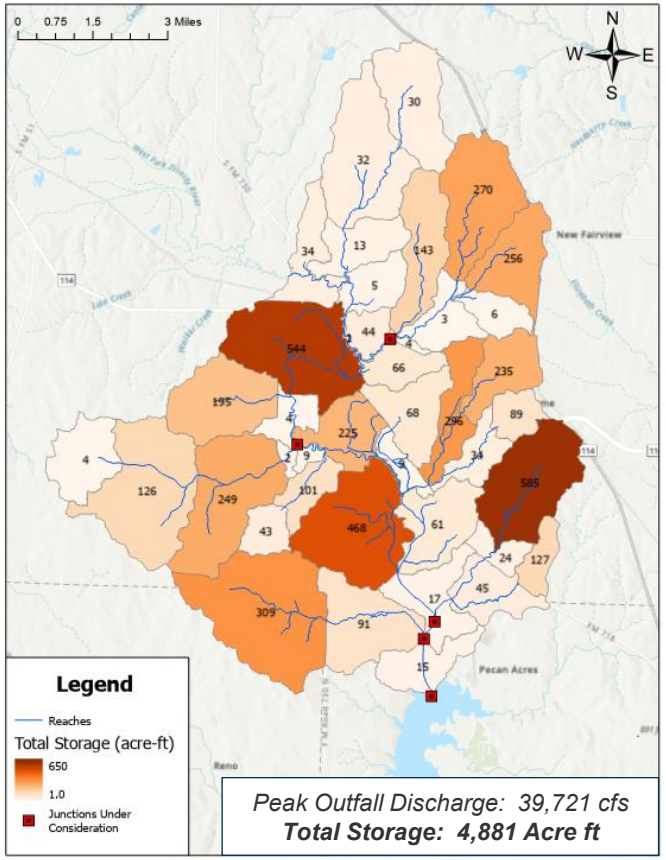
Vary Storage Values to Best Reduce the Peak Flow

Set Up Hydrologic & Hydraulic (H&H) Model w/ Reservoirs at Each Subbasin

Optimized Storage Values generated from H&H Runs



Distributed Detention Optimization Example – **Eagle Mountain Pilot**



Junctions Focus on Critical Locations Informed by **Transportation Parameters**

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TSI Optimization – Justifying Transportation Priority
Integration Links Resilience & Asset Management

- **USDOT FY 2022-26 Strategic Plan:** "DOT will increase its effectiveness in ensuring infrastructure is resilient enough to withstand extreme weather."
- **Federal Highway Administration (FHWA)** requires extreme weather durability / adaptation be considered in:
  - FHWA programs & policies *(Order 5520)*
  - Transportation system, project-level, & operations / maintenance planning *(23 CFR 450)*
  - Transportation Asset Management Plans *(23 CFR 515)*
  - 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

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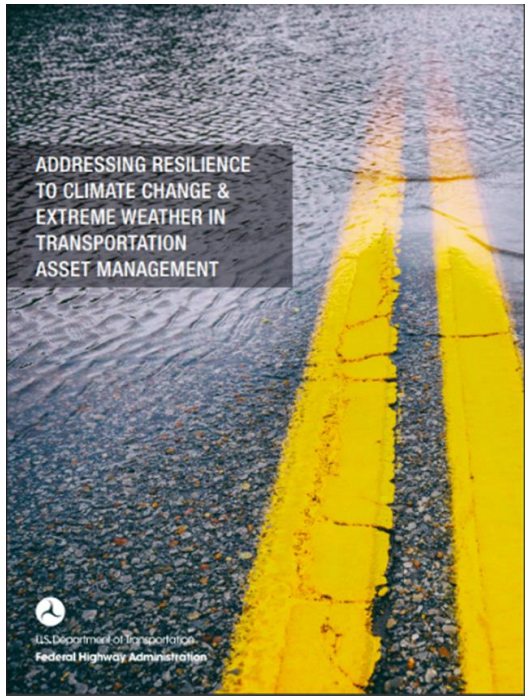
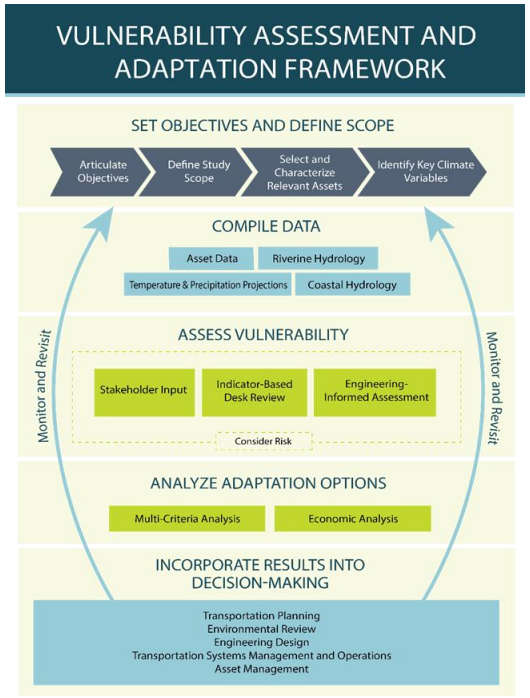
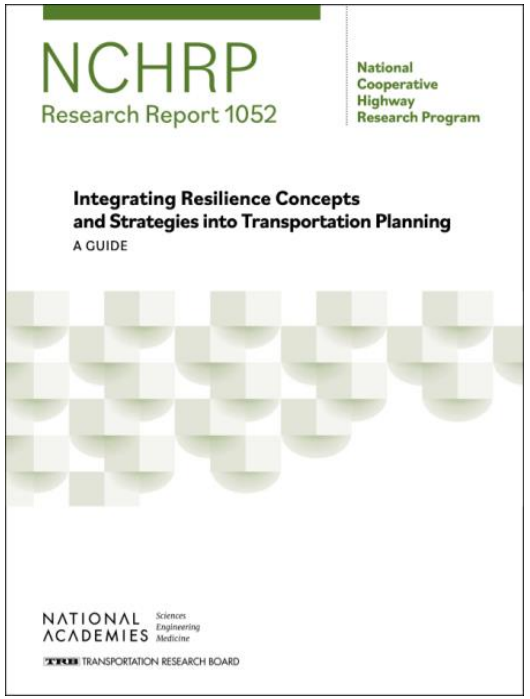


Source: FHWA (2023)



Source: FHWA (2017)



Source: NCHRP (2023)

TSI Optimization – Selecting Bridges/Culverts
Data Sources/Analysis & Methodology

DATA SOURCES *(within GIS)*:

- **TSI North/West Study Area**
- Future Road Locations (2045) – TxDOT
- Bridges/Culverts – TxDOT/National Bridge Inventory *(NBI)*
  - Dallas District *(Dallas, Denton, & Ellis)*
  - Fort Worth District *(Hood, Johnson, Parker, Tarrant, & Wise)*
- H&H Model Elements – USACE/UTA/Texas A&M AgriLife
  - Watershed Subbasins
  - Junctions & Reaches

ANALYSIS:

- Only bridges/culverts co-located with junctions are viable.
- Bridges/culverts most upstream in watershed are removed.
- All bridges/culverts on the main stem are included.
- At least one bridge/culvert per tributary should be included.

METHODOLOGY:

Select bridges / culverts relevant to each watershed.

↓

Determine which watershed bridges / culverts can be used based on H&H modeling.

↓

Prioritize & finalize selection of bridges / culverts.

↓

Determine corresponding H&H model junctions to apply optimization constraints.

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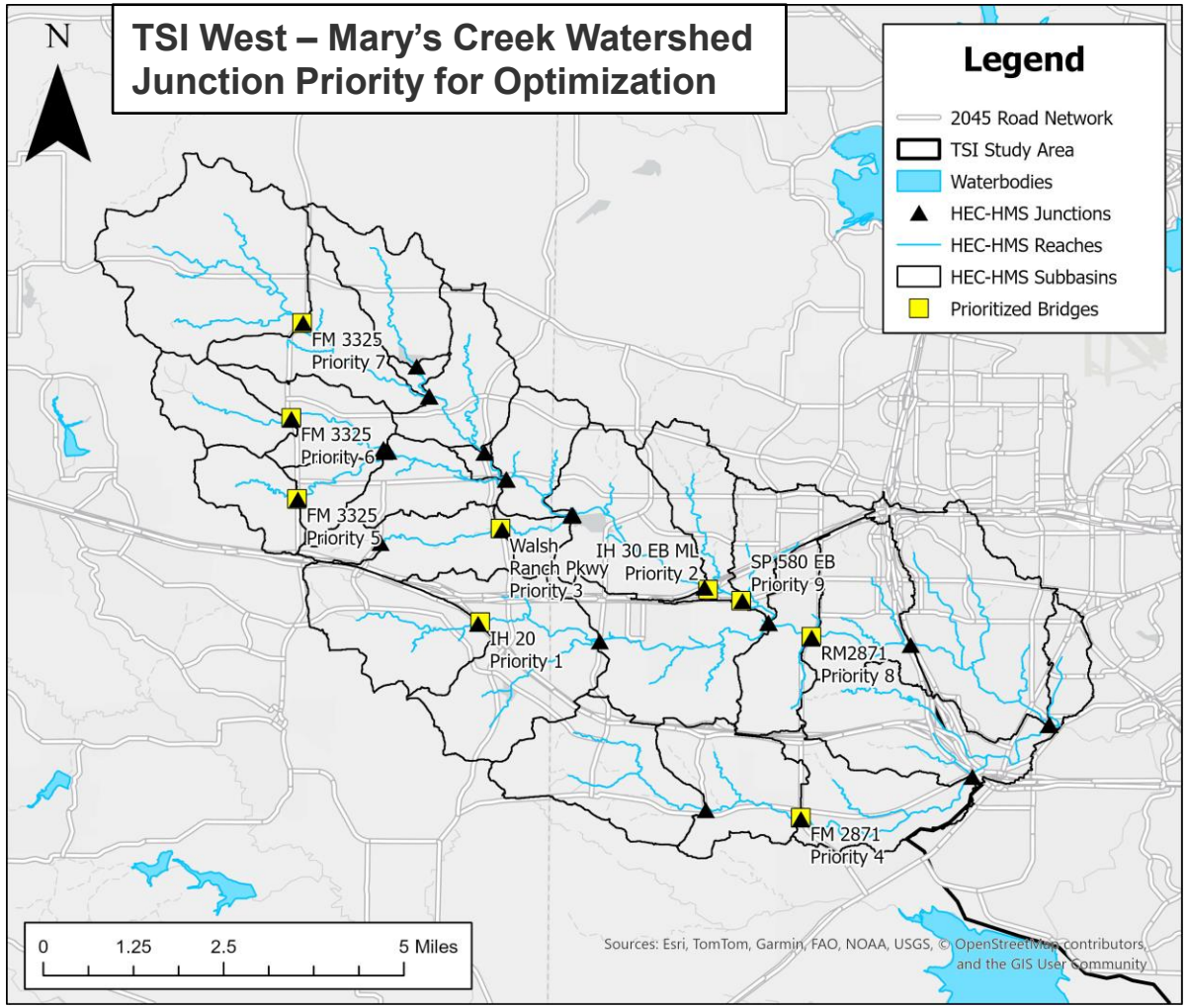
TSI Optimization – Selecting Bridges/Culverts
Sorting & Prioritizing Bridges/Culverts by Watershed

ATTRIBUTES FOR PRIORITIZATION:

- "Scour-Critical" Bridges – Bridge piers/abutments already unstable due to flood scouring *(via inspection)*
- Average Daily Traffic (ADT) –
  - Current *(TxDOT/NBI – Inspection Year)*
  - Future *(see below)*
    - Federal Highway Administration *(FHWA)* requires future ADT projected between 17-22 years from inspection date *(variable)*
    - If available, year 2050 NCTCOG Travel Model volumes used for more robust planning horizon & improved H&H consistency
- Inventory Route Functional Classification *(FC)*
- Detour Length
- Historical Significance
- Other factors depending on watershed relevance:
  - Intersecting Routes *(ADT, FC, & Detour Length)*
  - Critical Facility & Navigational Control Indicators



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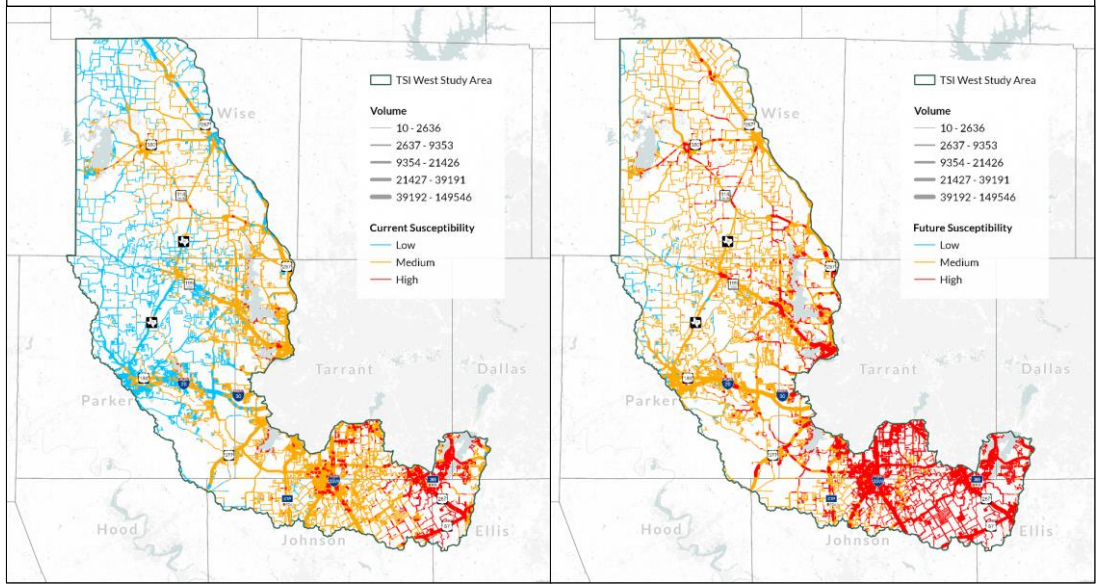
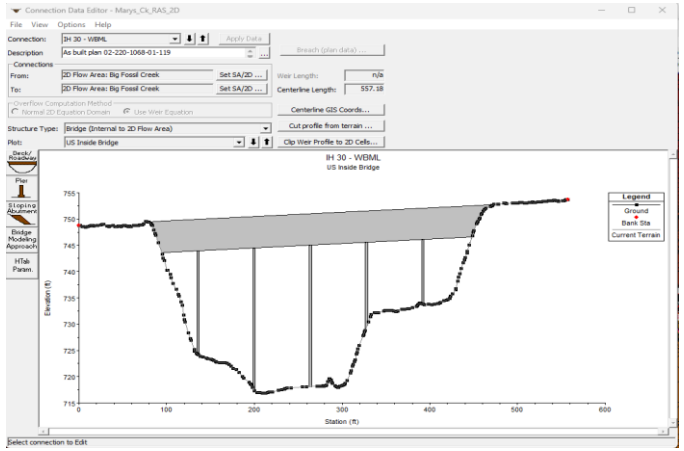
TSI Optimization – Progress & Next Steps
Alternative Analysis Alignment/Expansion Over TSI Study Area

- Initial junction priority created for Eagle Mountain, Mary's Creek, Mountain Creek, & Village Creek watersheds
- Initial flood vulnerability & susceptibility *(shown right)* maps for transportation facilities completed using Texas A&M AgriLife environmental stacking model
- General Land Office *(GLO)* Combined River Basin Flood Studies *(RBFS)* Hotspot ID screening underway in various TSI North pilot watersheds
- Reconciling Base Level Engineering (BLE) 1D vs. 2D model considerations between TSI North/West watersheds
- Deploy incorporated H&H, stacking model, & optimization inputs for flood mitigation analysis across TSI Study Area:

MILESTONE	DELIVERY DATE
Full TSI Alternatives Analysis Launch	October 2025
Draft Identification of Flood Mitigation Projects, Strategies, & Evaluations with Economic Results	February 2026
Document Final Alternatives Analysis Results in Final TSI Study Report & Replication Plan	June 2026

Transportation Facility Flood Susceptibility – TSI West





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Junction Solutions – What Could the TSI Study Deliver?
Flood Reduction / Prevention Concepts – Brainstorming #1

Transportation Infrastructure

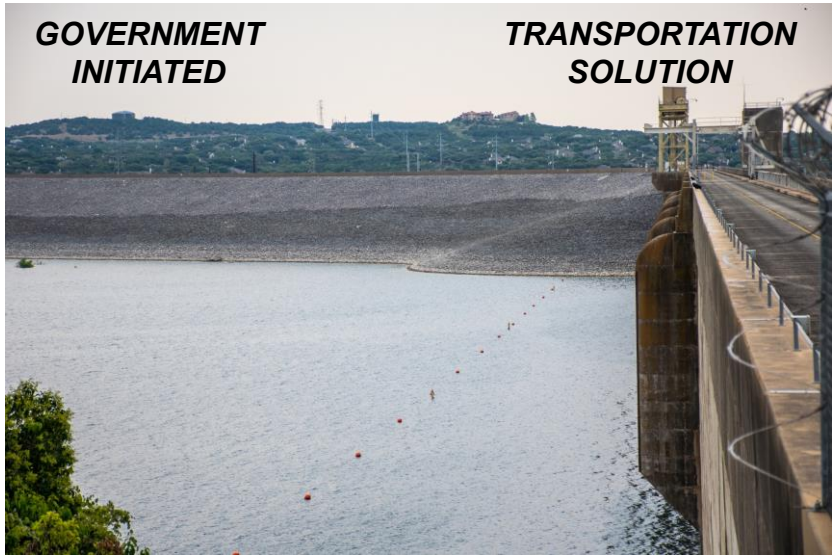
- Structural Characteristics
  (elevation, materials, flow capacity, etc.)
- Culvert Use / Type
  (system applications, mechanical, etc.)
- Transportation "LEED" Certification
  (Lake Ray Roberts / Lake Lewisville)
- Green Parkway Width / Detention

Safety

- Technology / Routing / Emergency Response
- Prioritization of Low-Lying Facilities

Stormwater Management

- Minimize Downstream Detention
- Tools, Data, & Experts



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Junction Solutions – What Could the TSI Study Deliver?
Flood Reduction / Prevention Concepts – Brainstorming #2

Environmental Features

- Preservation of Sensitive Areas
  (open space, tree cover, development setbacks, etc.)
- Intentional Saturation / Filtration
  (bioswales, aquifer recharge, retention ponds, etc.)
- Mitigation Banking
  (constructed wetlands, riparian preservation, etc.)

Stewardship – Equity / Revenue Elements

- High-Quality Development Incentives
  (all markets)
- Recreation / Eco-Tourism Opportunities
  (horse farms, "pocket" parks, etc.)
- Character Preservation
  (rural, cultural, historical, etc.)

To provide a menu of options and identify location(s) where they make sense.

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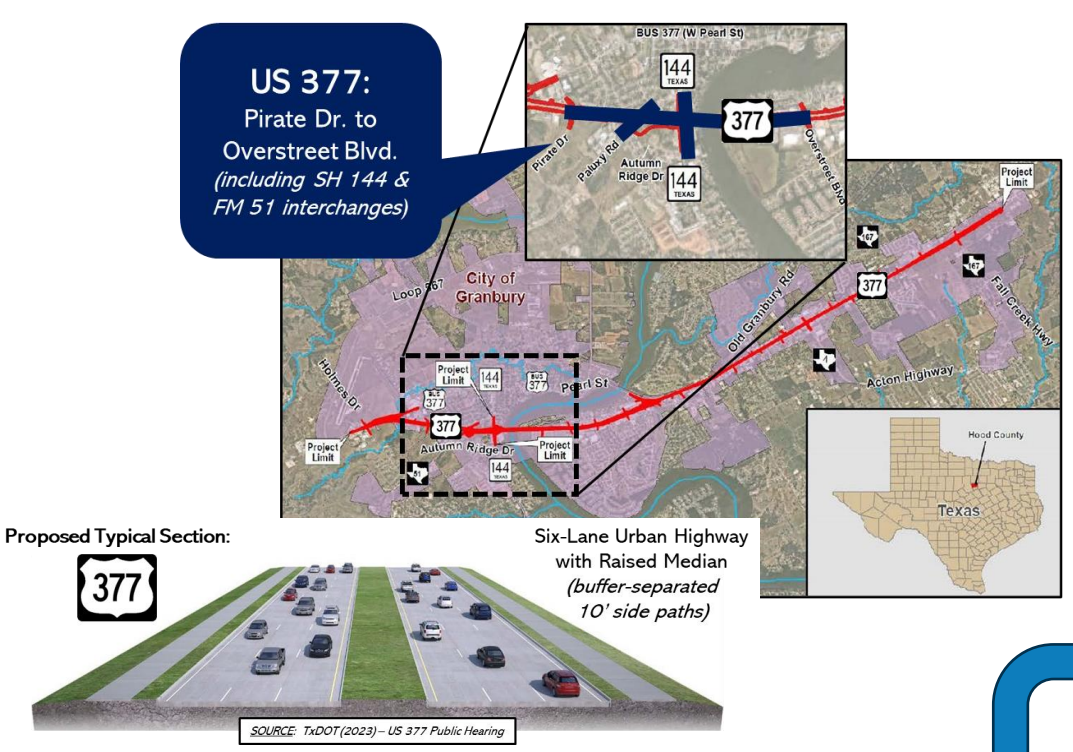
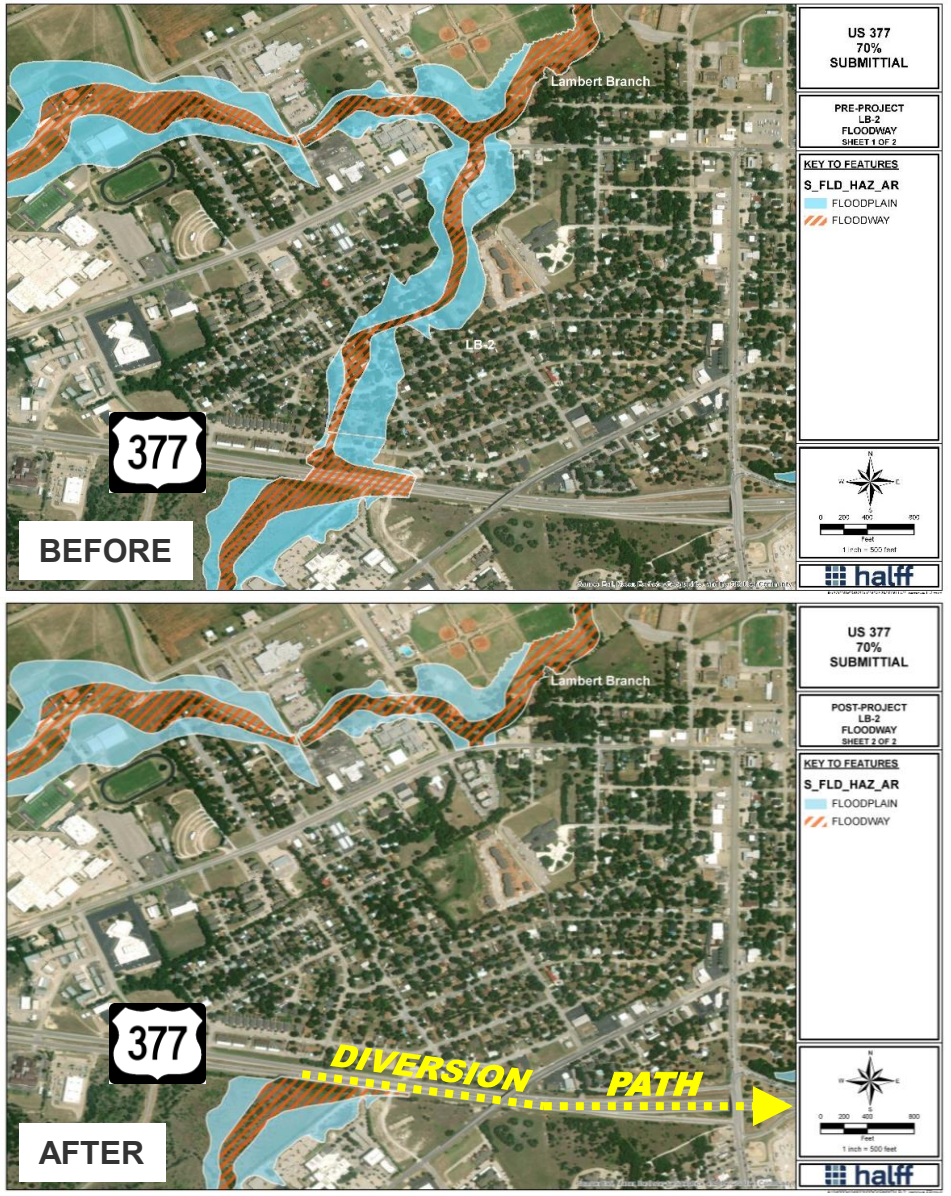
Junction Solutions – What Could the TSI Study Deliver?
Infrastructure Silo-Busting Examples – Granbury, TX





- **Stormwater Diversion Example – US 377/SH 144**
  - Alleviates flood risks for more than 70 properties below 100-year floodplain in Heather Drive neighborhood
  - Diversion located within US 377 right-of-way (ROW) for direct path into Lake Granbury

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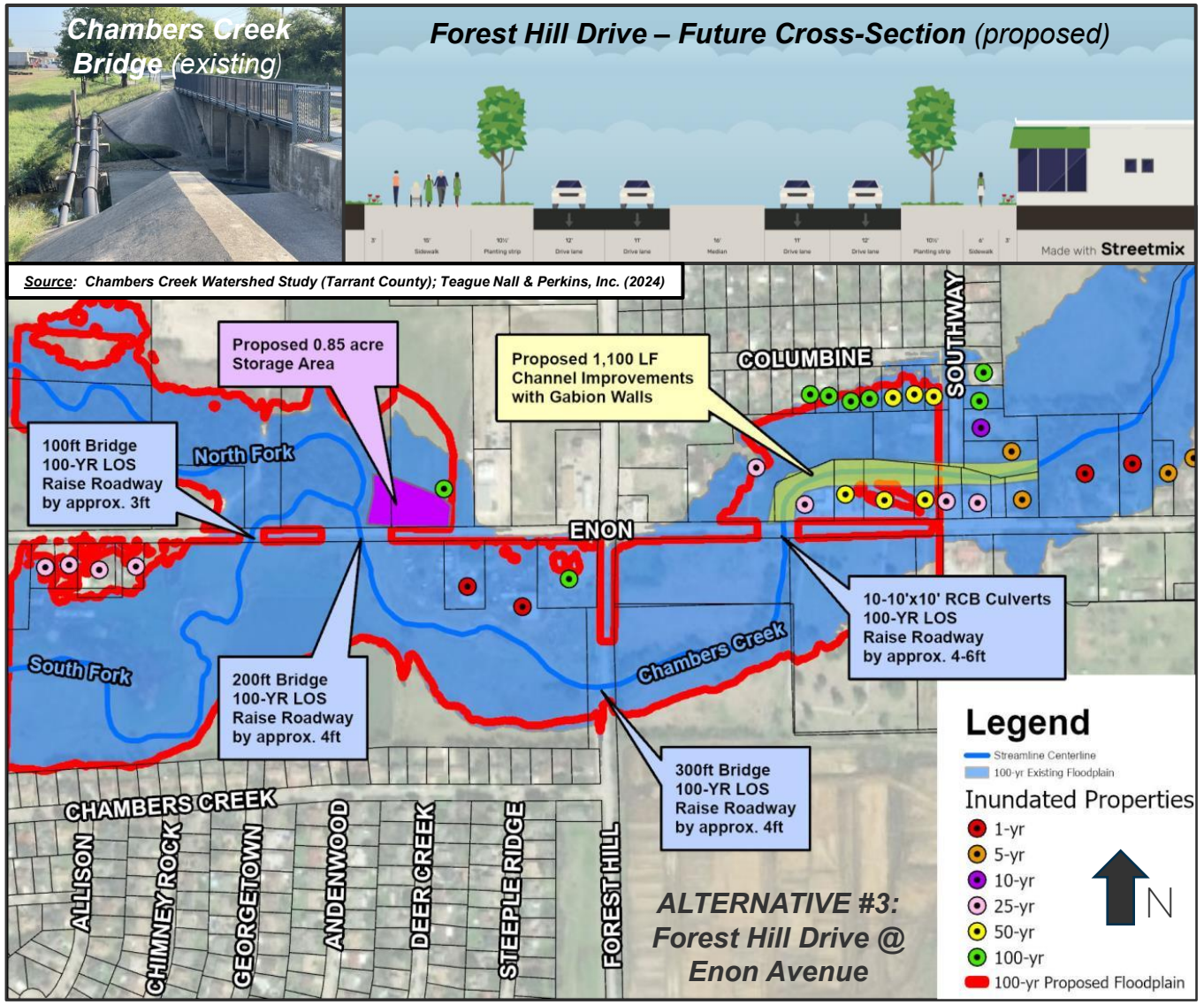
Junction Solutions – What Could the TSI Study Deliver?
Infrastructure Silo-Busting Examples – Everman, TX

- **Forest Hill Drive Study** ***(2023-24)*** identified recommendations for alignment, capacity, & configuration in Everman, Forest Hill, & Fort Worth *(Lon Stephenson Rd – Shelby Rd)*
  - Located within larger **TSI Study** area
  - Major flood events in 2015, 2018, & 2022
  - Expecting substantial cost share related to integrating thoroughfare/stormwater needs
  - Vicinity of Chambers Creek crossings requires Enon Avenue reconstruction/raising as part of Forest Hill Drive widening *(see map at right)*
  - *"Land banking"* options for detention already considered in initial stakeholder discussions
  - **TSI Study** feedback vital to identify/optimize *"land banking"* uses, locations, & policies
  - Existing precedents for NCTCOG *"land banking"* in other transportation projects *(e.g., Arlington, Irving, NRH, & White Settlement)*



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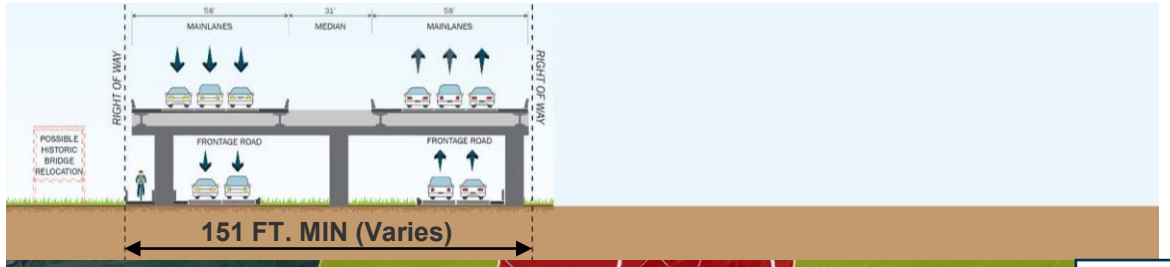
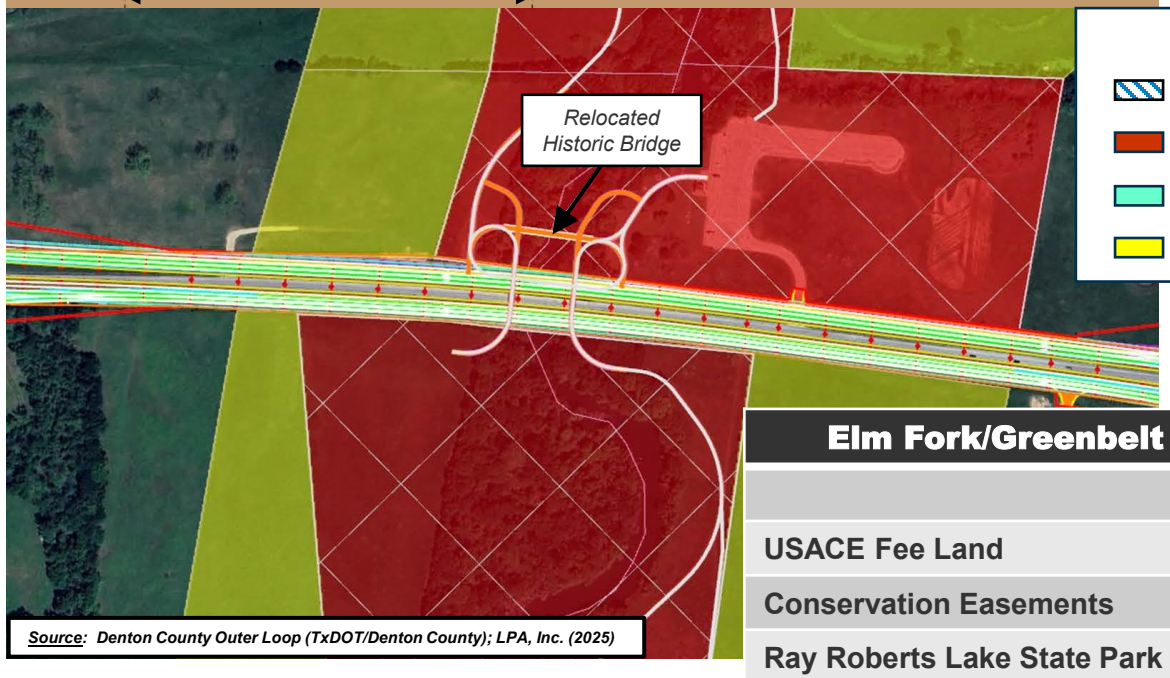
Junction Solutions – What Could the TSI Study Deliver?
Infrastructure Silo-Busting Examples – Denton, TX

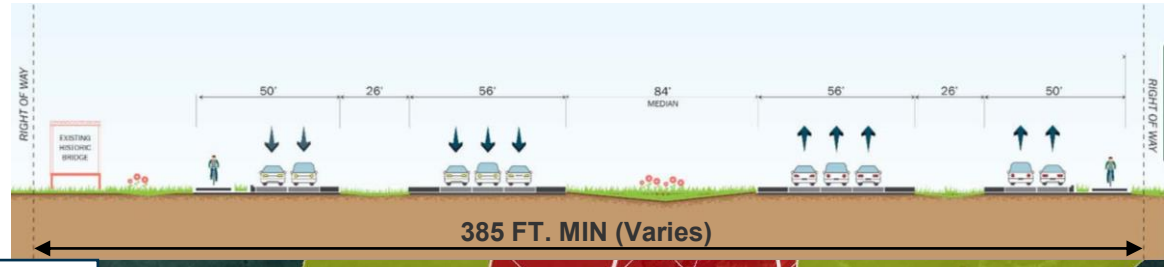
DENTON COUNTY OUTER LOOP – STACKED OPTION

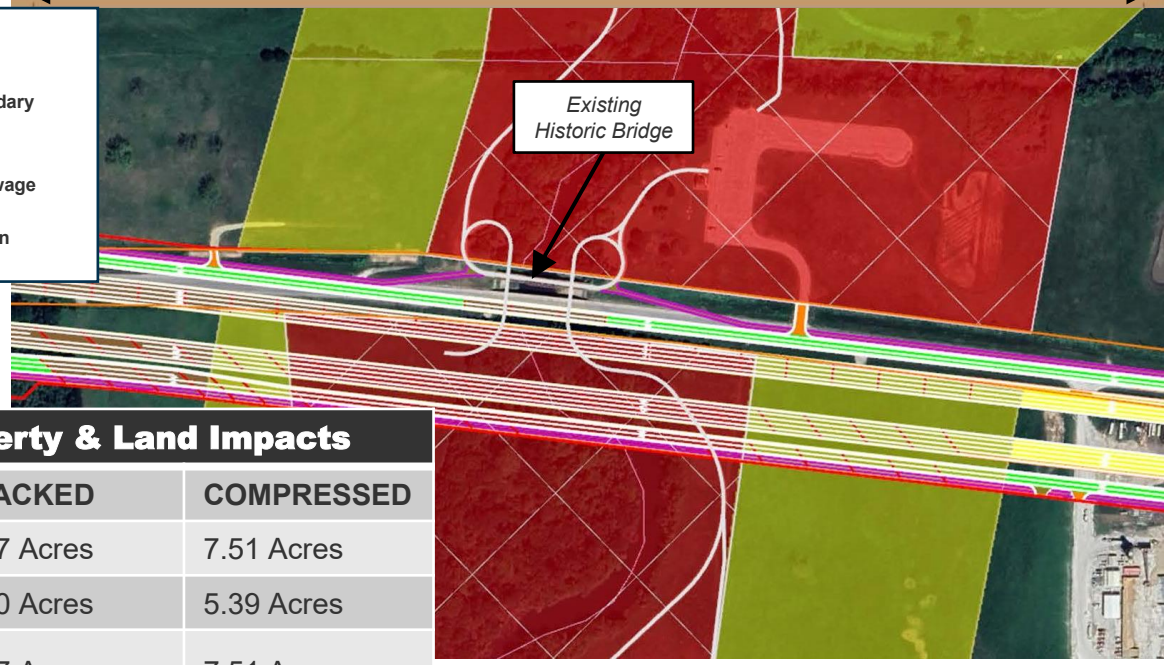




Source: Denton County Outer Loop (TxDOT/Denton County); LPA, Inc. (2025)

DENTON COUNTY OUTER LOOP – COMPRESSED OPTION





LEGEND

- TPWD State Parks Boundary
- USACE Fee Property
- USACE Flowage Property
- Conservation Lands

Elm Fork/Greenbelt – Property & Land Impacts

	STACKED	COMPRESSED
USACE Fee Land	0.17 Acres	7.51 Acres
Conservation Easements	0.00 Acres	5.39 Acres
Ray Roberts Lake State Park – Greenbelt Unit	0.17 Acres	7.51 Acres
Environmentally Sensitive Area (Lake Lewisville Master Plan)	0.17 Acres	7.51 Acres
High Density Recreation Area (Lake Lewisville Master Plan)	0.00 Acres	0.00 Acres

Proposed Denton County Outer Loop
Typical Right-of-Way (ROW) = 500 FT.

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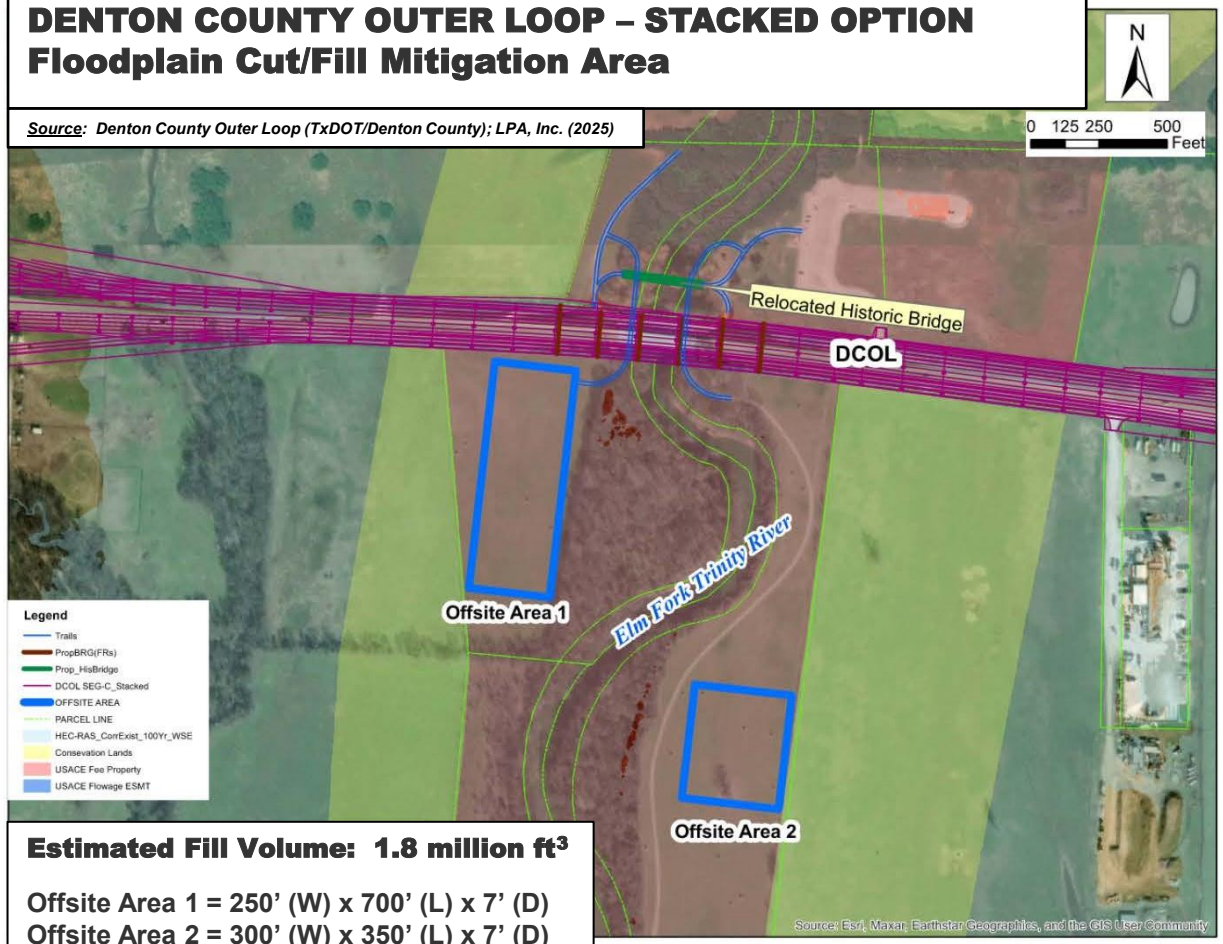
Junction Solutions – What Could the TSI Study Deliver?
Infrastructure Silo-Busting Examples – Denton, TX (cont.)

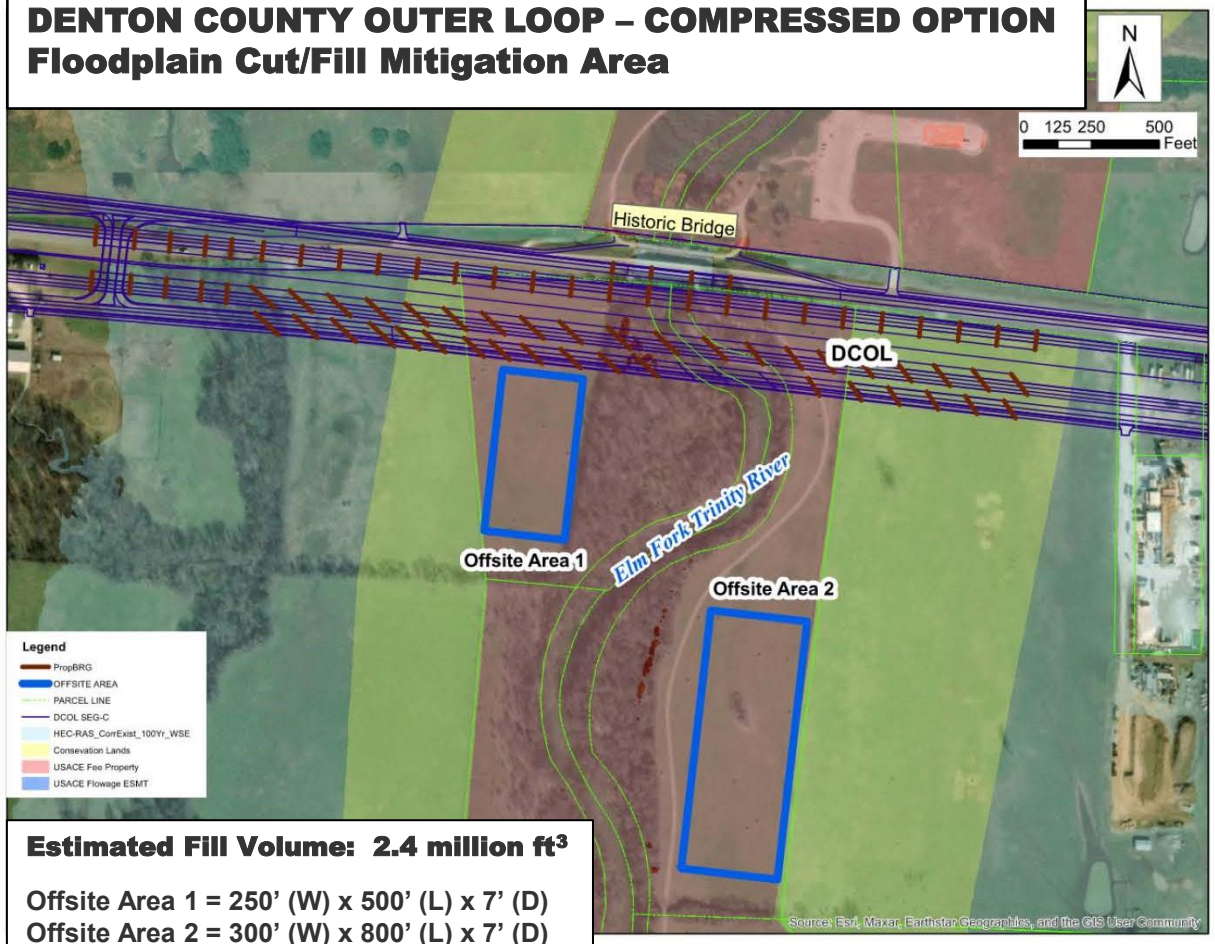
DENTON COUNTY OUTER LOOP – STACKED OPTION
Floodplain Cut/Fill Mitigation Area



Estimated Fill Volume: 1.8 million ft³

Offsite Area 1 = 250’ (W) x 700’ (L) x 7’ (D)
Offsite Area 2 = 300’ (W) x 350’ (L) x 7’ (D)

DENTON COUNTY OUTER LOOP – COMPRESSED OPTION
Floodplain Cut/Fill Mitigation Area



Estimated Fill Volume: 2.4 million ft³

Offsite Area 1 = 250’ (W) x 500’ (L) x 7’ (D)
Offsite Area 2 = 300’ (W) x 800’ (L) x 7’ (D)

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