



North Central Texas
Council of Governments

Model Enhancements

TSI Subarea Meeting

May 2026



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.

Hydrology Model Enhancements

InFRM Watershed Hydrology Assessments (WHA) are being enhanced.

InFRM WHA for Trinity Basin:

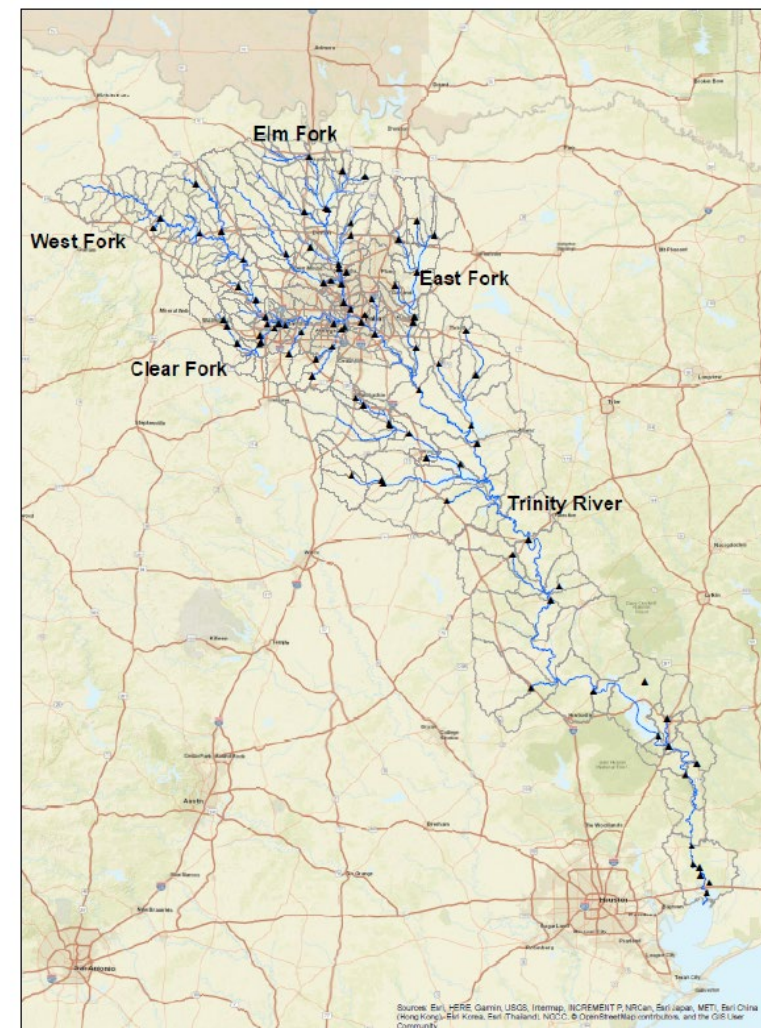
- FEMA sponsored study
- Completed 2021
- Expert team of engineers and scientists across multiple federal agencies
- Significant stakeholder engagement and input
- Extensive model calibration
- Multiple hydrologic methods
- Consistent and defensible results from the headwaters to the gulf
- Recommended as the basis for future flood risk studies.
- Results have been used to update FEMA FIS Maps (eg, East Fork Trinity River)
- Models available to public at no charge.



Interagency Flood Risk Management (InFRM)

Watershed Hydrology Assessment for the Trinity River Basin

July 2021



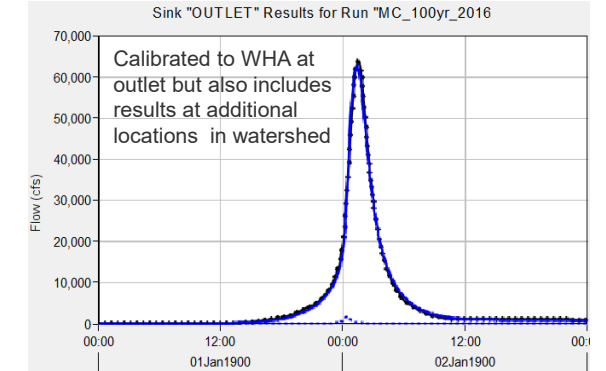
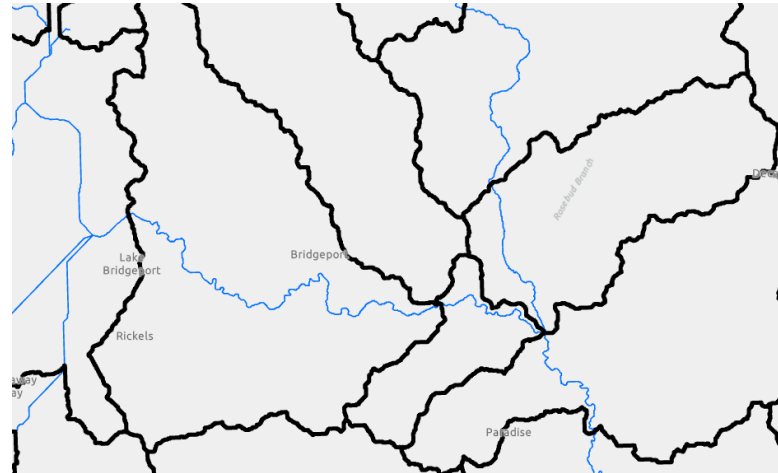
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Swisstopo, Esri Korea, Esri (Thailand), NOAA, OpenStreetMap contributors, and the GIS User Community

Hydrology Model Enhancements

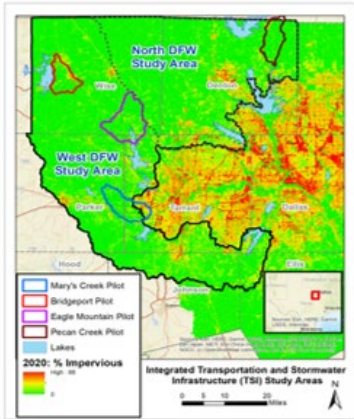
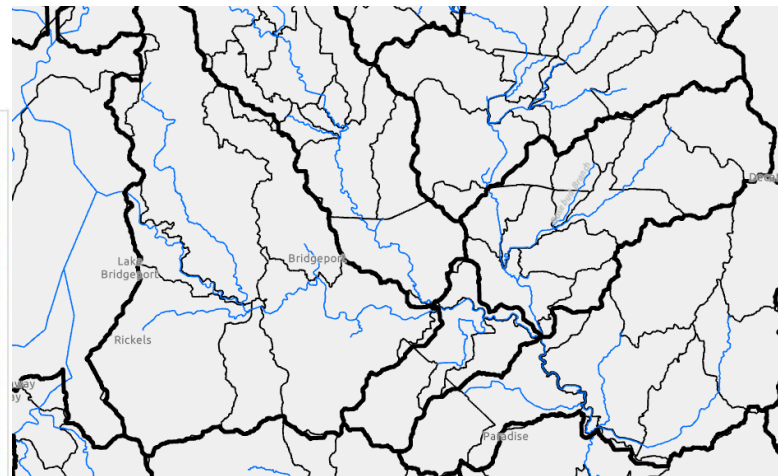
Steps:

- Additional Model Detail
- 2016 Conditions
- Initial Parameters
- Calibration to WHA Results
- 2020 and 2070 Conditions...including valley storage loss
- Simulate Frequency Events
- Informs Optimization Analysis
- HMS Results also used in RAS and SWAT Models (Green Storm Infrastructure)

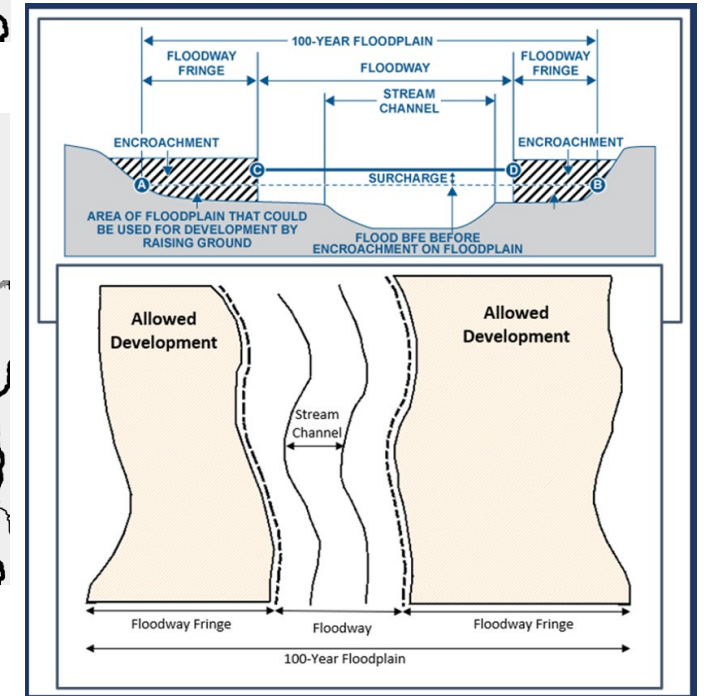
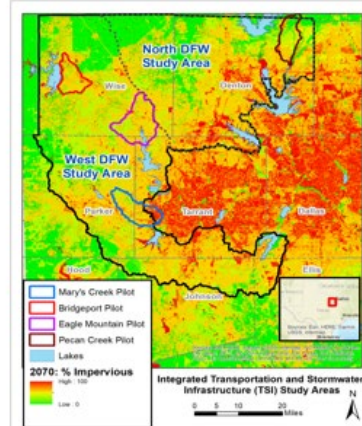
Example showing WHA detail



Example showing additional TSI detail



2020
VS.
2070



Hydrology Model Enhancements

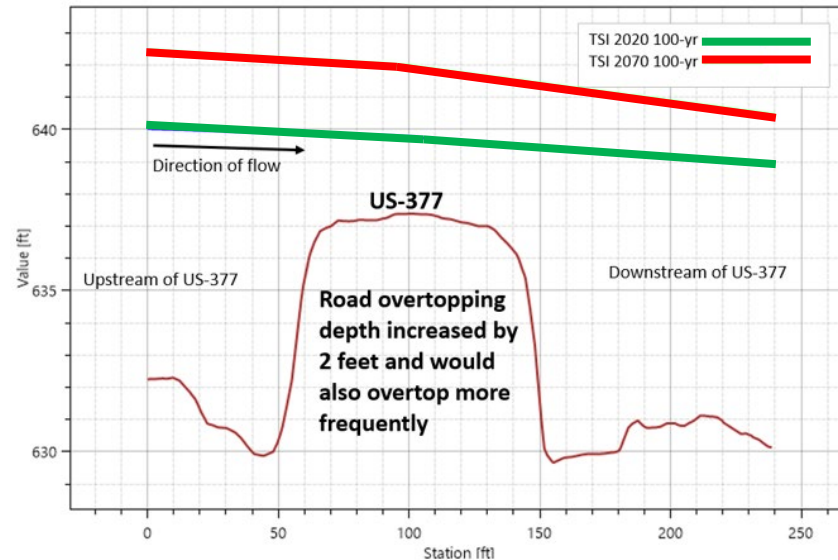
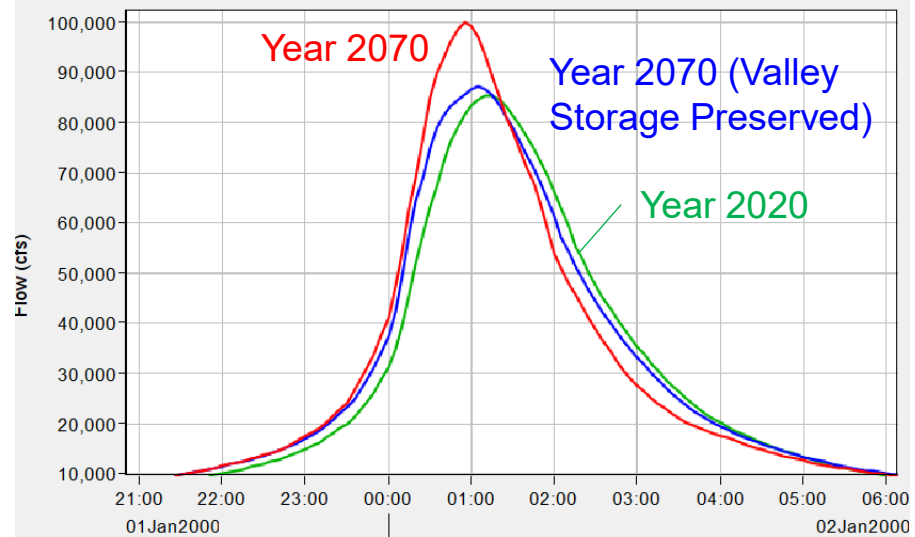
Why future land use and future valley storage?

- Peak flow increases
- Peak water surface elevation increases
- Deeper and more frequent roadway overtopping
- Shorter flood response times

Valley Storage...No encroachment



Allowed encroachment under NFIP



Hydrology Model Enhancements

Additional Model Detail and Calibration:

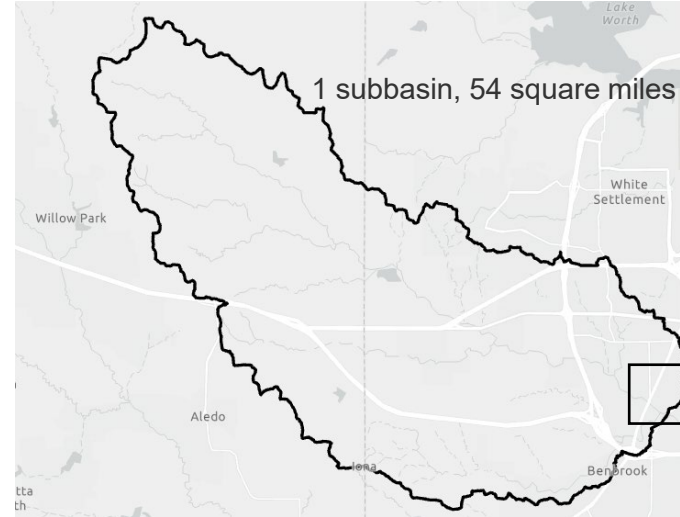
- More subbasins with new initial parameters consistent with WHA parameters
- TSI model calibrated to WHA by adjusting initial parameter estimates
 - Lag times
 - Peaking Coefficient
 - Routing sub reaches and storage-discharge

$$T_L = C_T(L \cdot L_{CA}/S^{0.5})^{0.38}$$

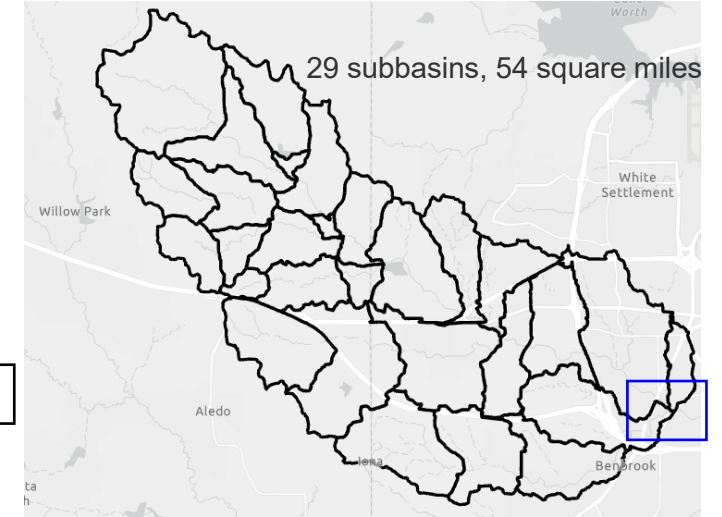
Hydrologic and Hydraulic Guidelines for Dams in Texas

Dam Safety Program
Texas Commission on Environmental Quality

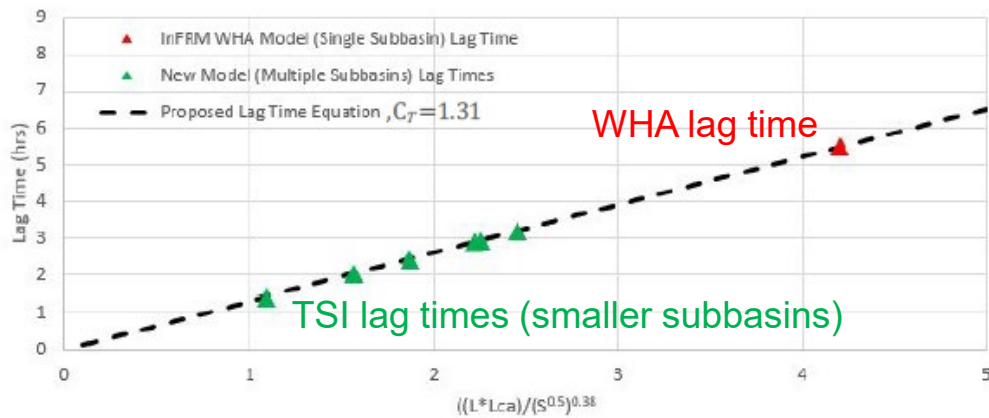
Example showing WHA detail



Example showing additional TSI detail



Lag Time Computations



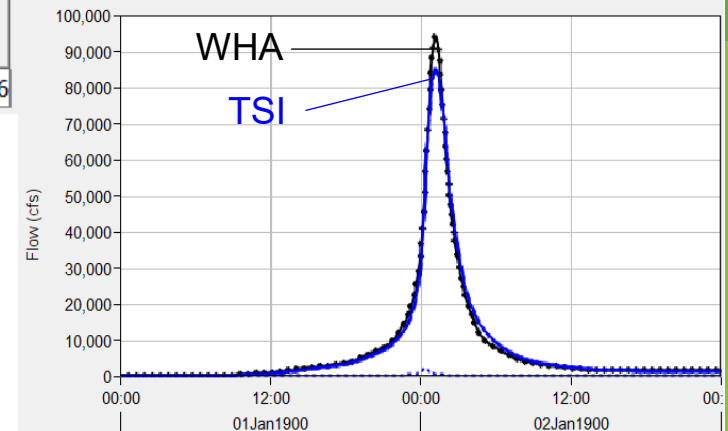
WHA

Subbasin	Snyder Method	Lag Time (HR)	Peaking Coefficient
Marys_Ck_S010	Standard	1.5	0.76

TSI

Subbasin	Snyder Method	Lag Time (HR)	Peaking Coefficient
Marys_Creek_S001	Standard	0.632	0.76
Marys_Creek_S002	Standard	0.607	0.76
Marys_Creek_S003	Standard	0.569	0.76

Sink "OUTLET" Results for Run "MC_500yr_2016"



Hydrology Model Enhancements

Future (2070) Conditions:

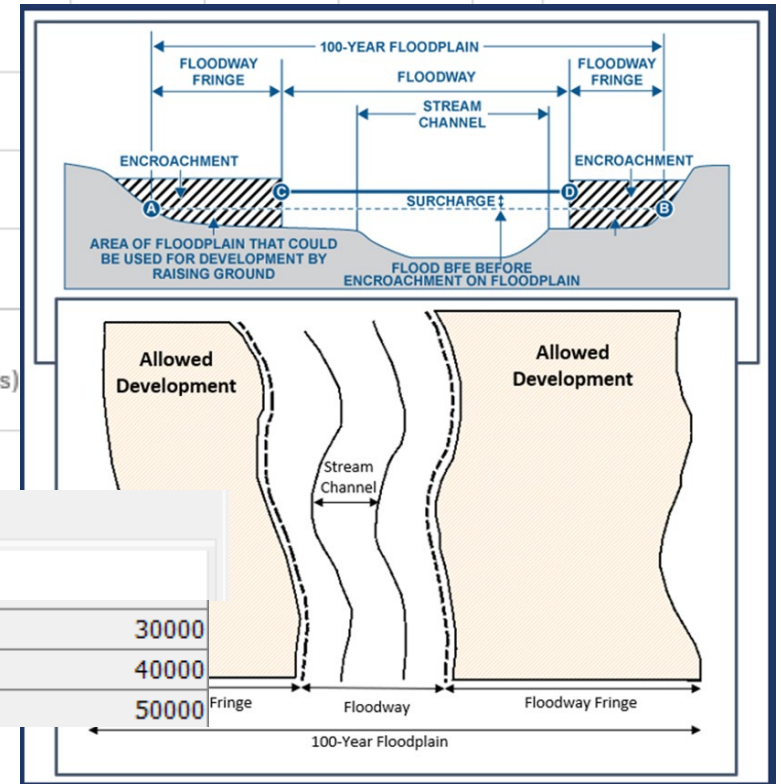
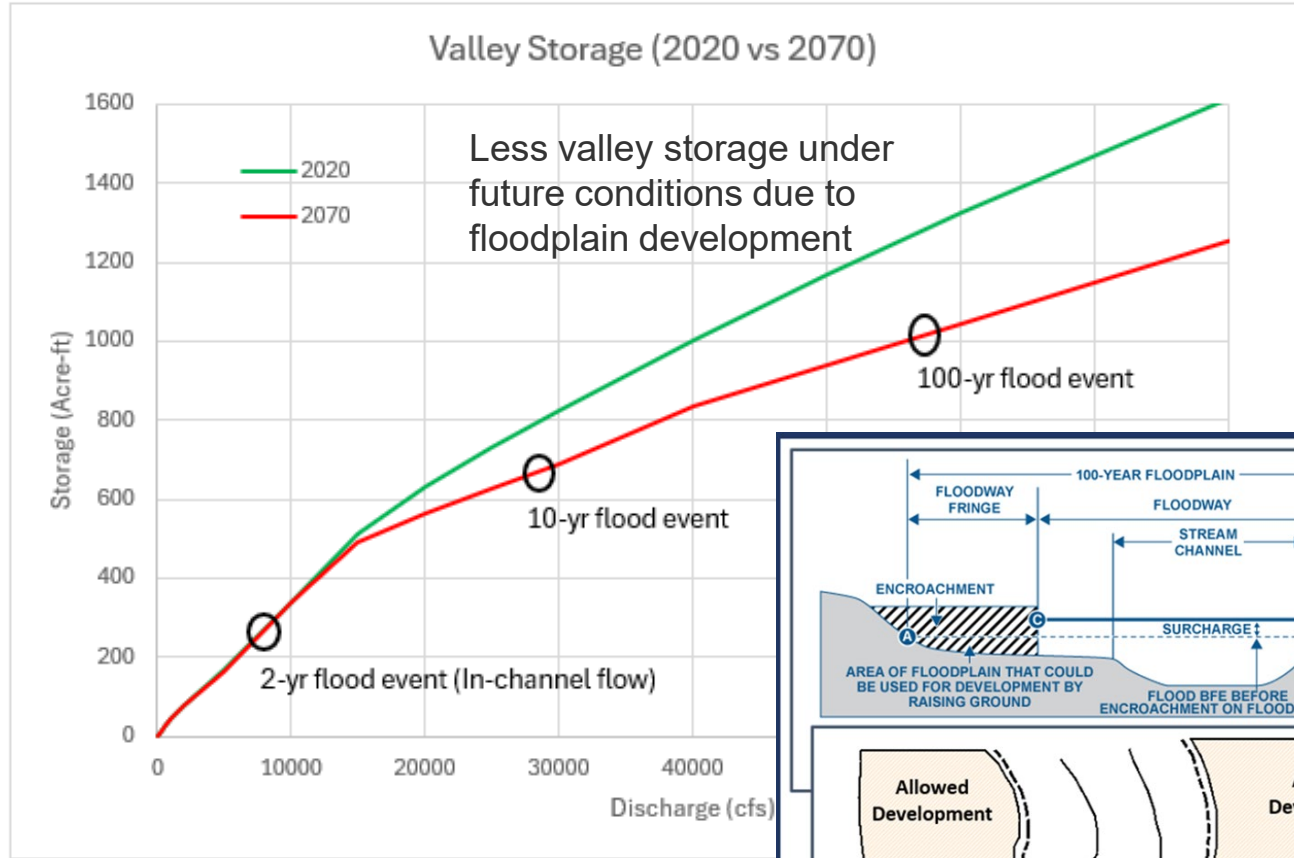
- Higher impervious percentages
- Shorter lag times
- Reduced storage volumes in routing reaches

Subbasin	Initial Loss (IN)	Constant Rate (IN/HR)	Impervious (%)
2020			
Little_MarysCk_S001	0.86	0.09	1
Little_MarysCk_S002	0.86	0.09	4

Subbasin	Initial Loss (IN)	Constant Rate (IN/HR)	Impervious (%)
2070			
Little_MarysCk_S001	0.86	0.09	41
Little_MarysCk_S002	0.86	0.09	38

Subbasin	Snyder Method	Lag Time (HR)	Peaking Coefficient
2020			
Little_MarysCk_S001	Standard	0.428	0.76
Little_MarysCk_S002	Standard	0.495	0.76

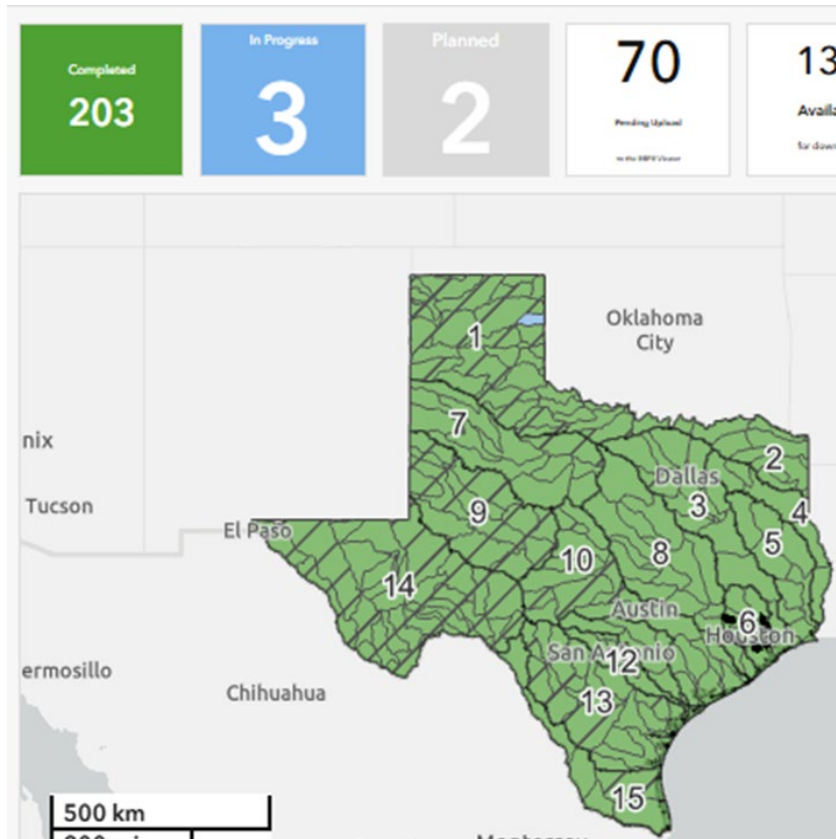
Subbasin	Snyder Method	Lag Time (HR)	Peaking Coefficient
2070			
Little_MarysCk_S001	Standard	0.310	0.76
Little_MarysCk_S002	Standard	0.367	0.76



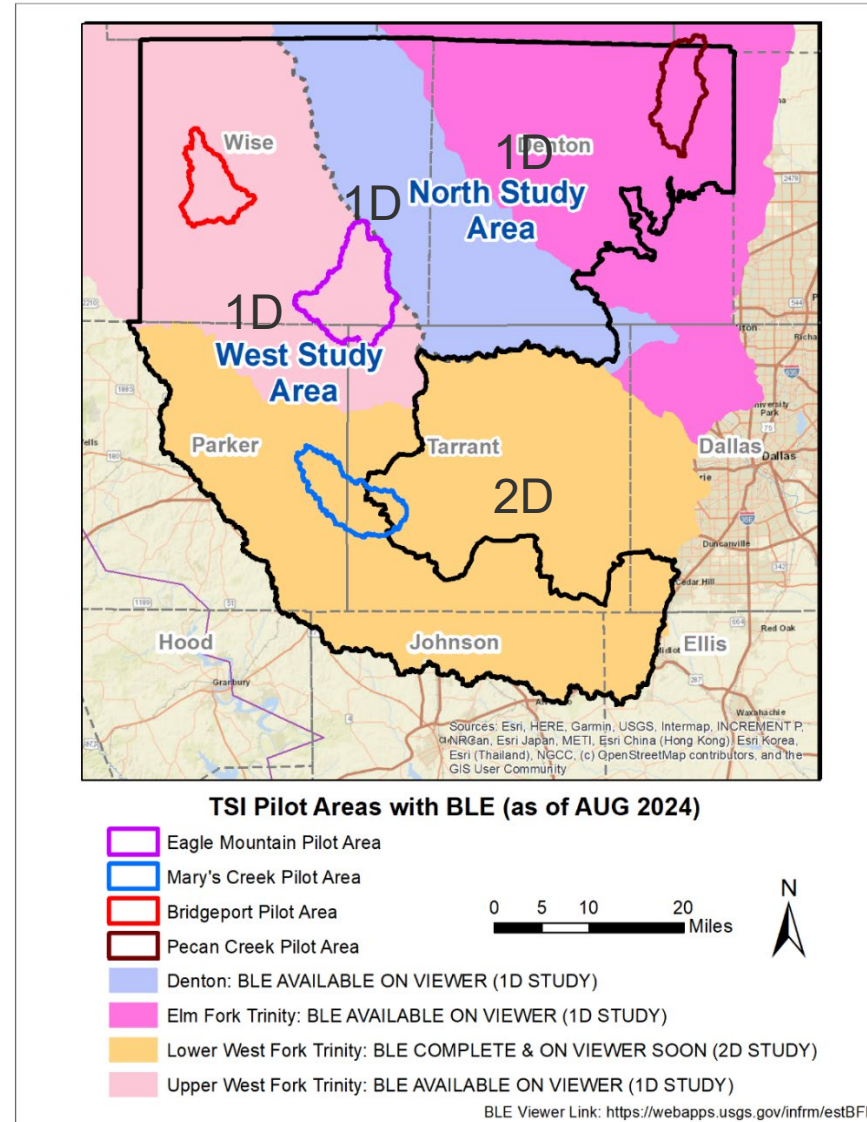
Storage (ACRE-FT)	Discharge (CFS)
823.0	30000
1000.8	40000
1168.0	50000

Hydraulic Model Enhancements

- Base Level Engineering Hydraulic Modeling available for Texas



<https://webapps.usgs.gov/infrm/estbfe/>



Hydraulic Model Enhancements

FEMA Base Level Engineering (BLE) models are being enhanced.



Enhanced Geometry, Flow, and Plan Files

Add Hydraulic Structures Using TxDOT As-Builts

Existing and Future Conditions Streamflows

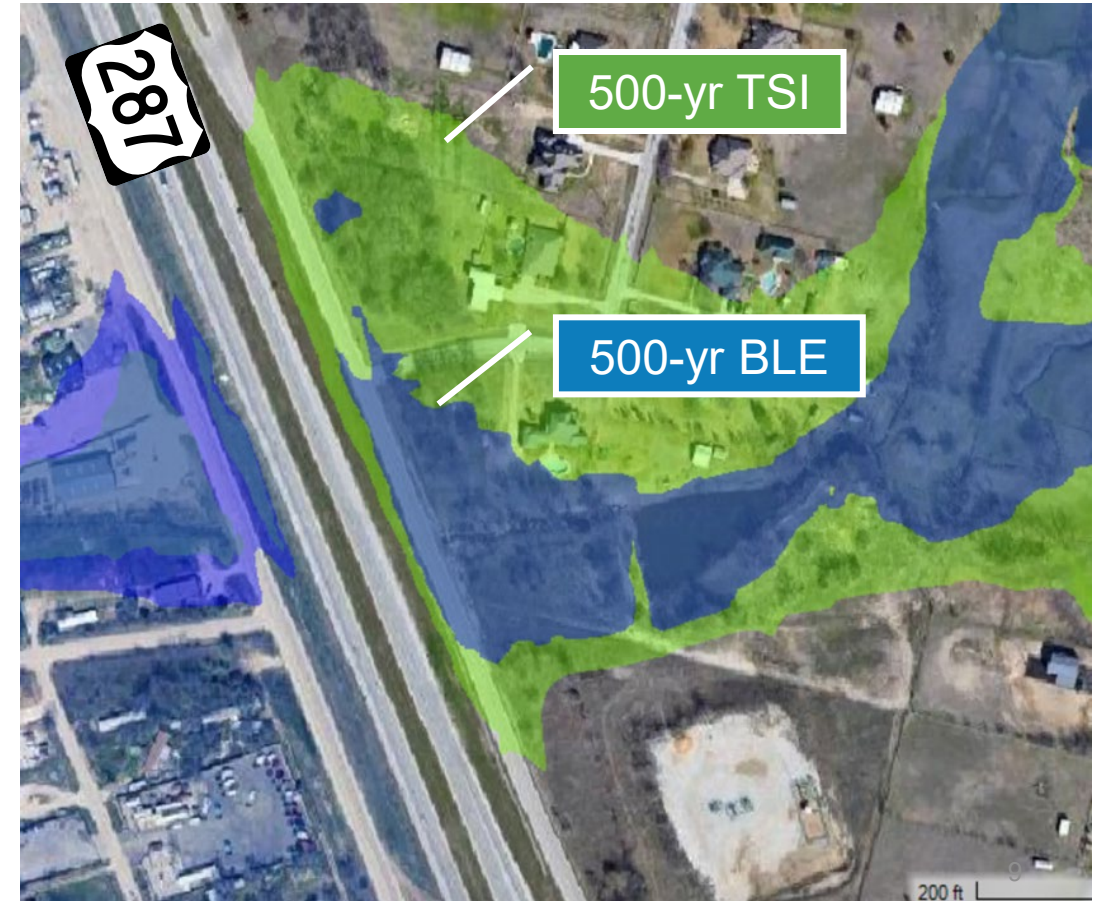
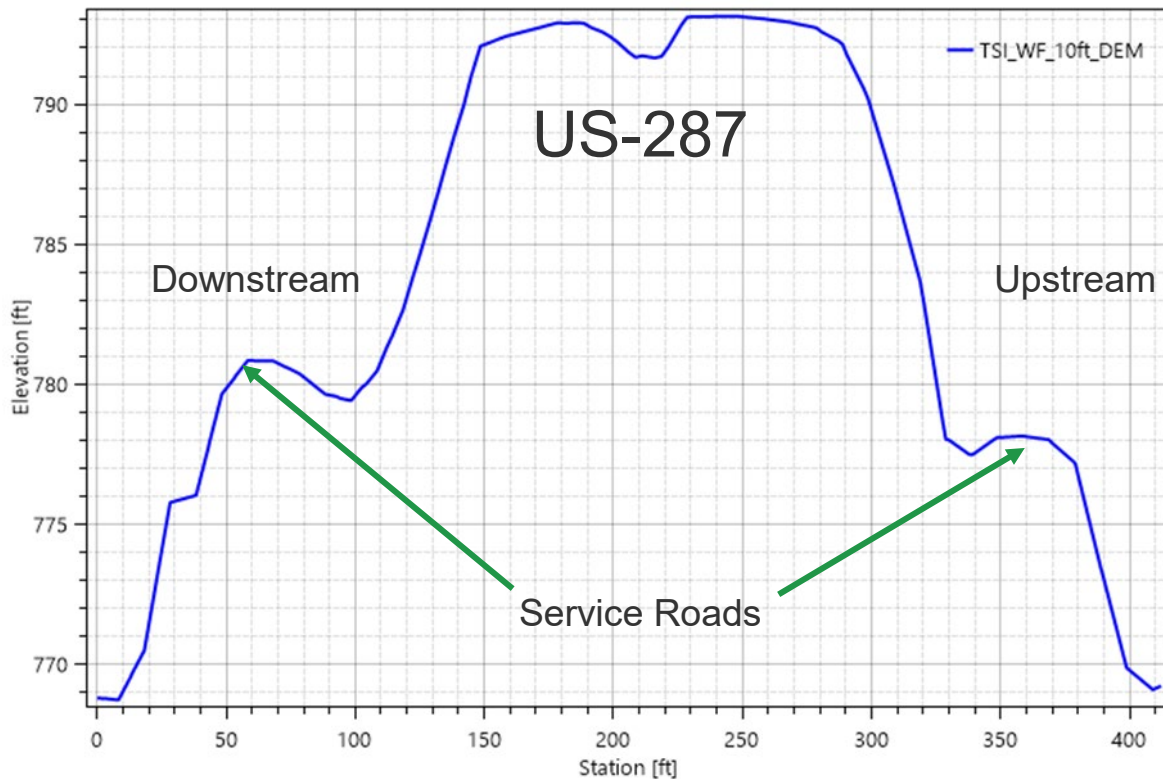
Simulate Frequency Events

Generate Existing and Future Conditions Floodplains

Leverage models for Alternative Analysis

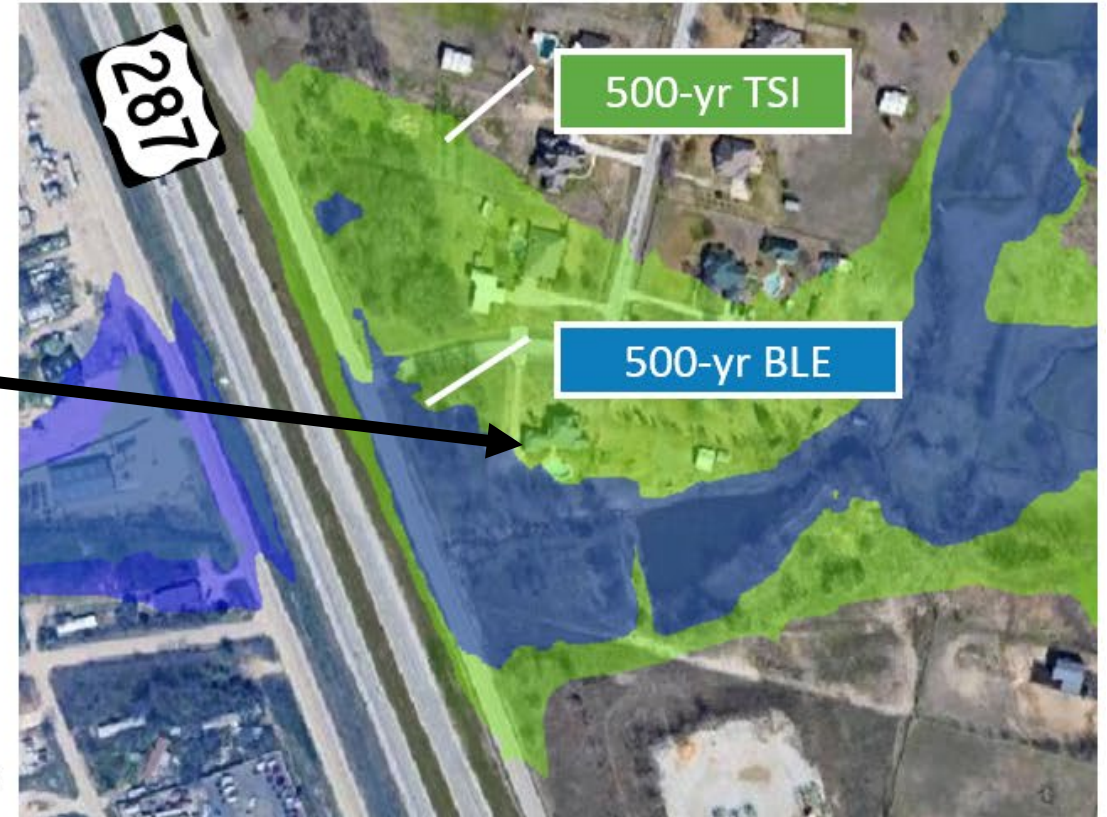
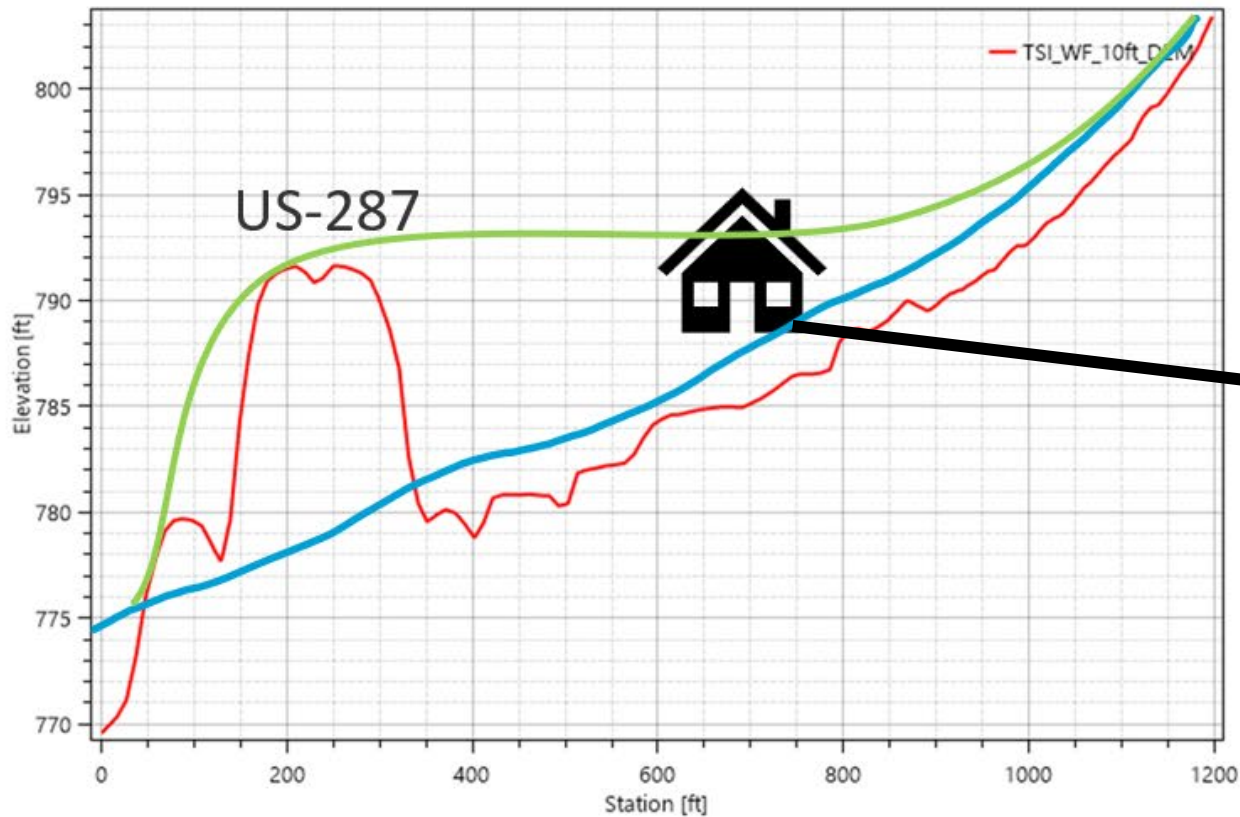
Hydraulic Model Enhancements (1D)

- BLE – Does not include railroad/roadway crossings
- TSI – Includes railroad/roadway crossings



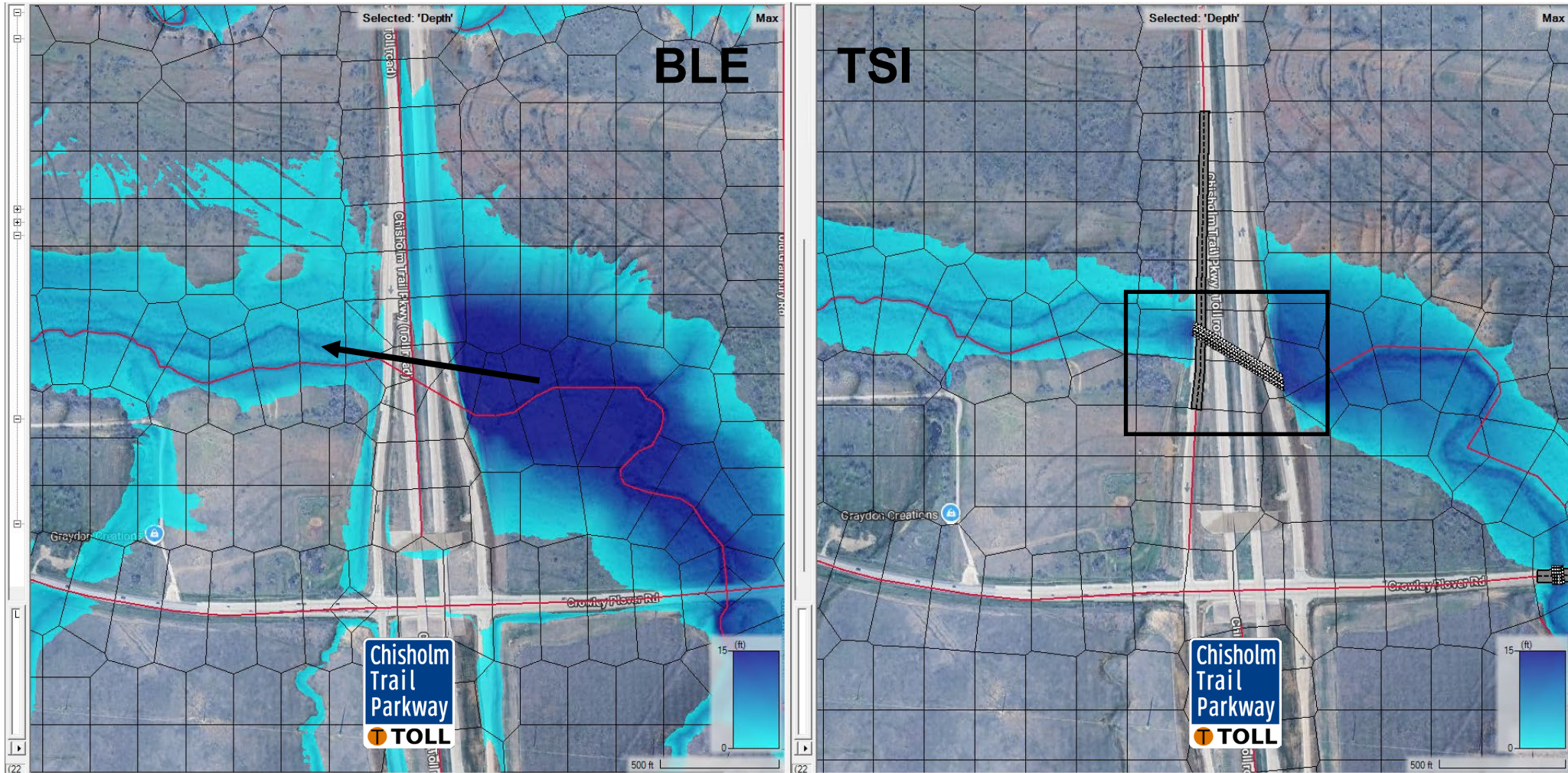
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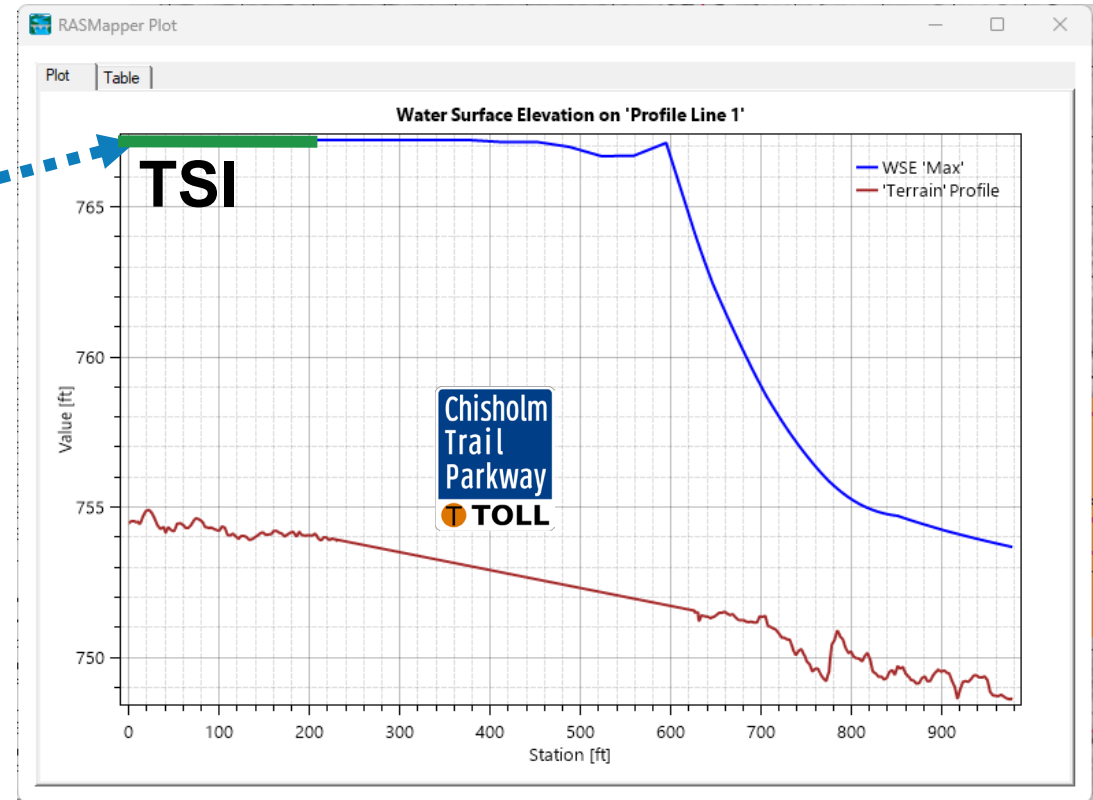
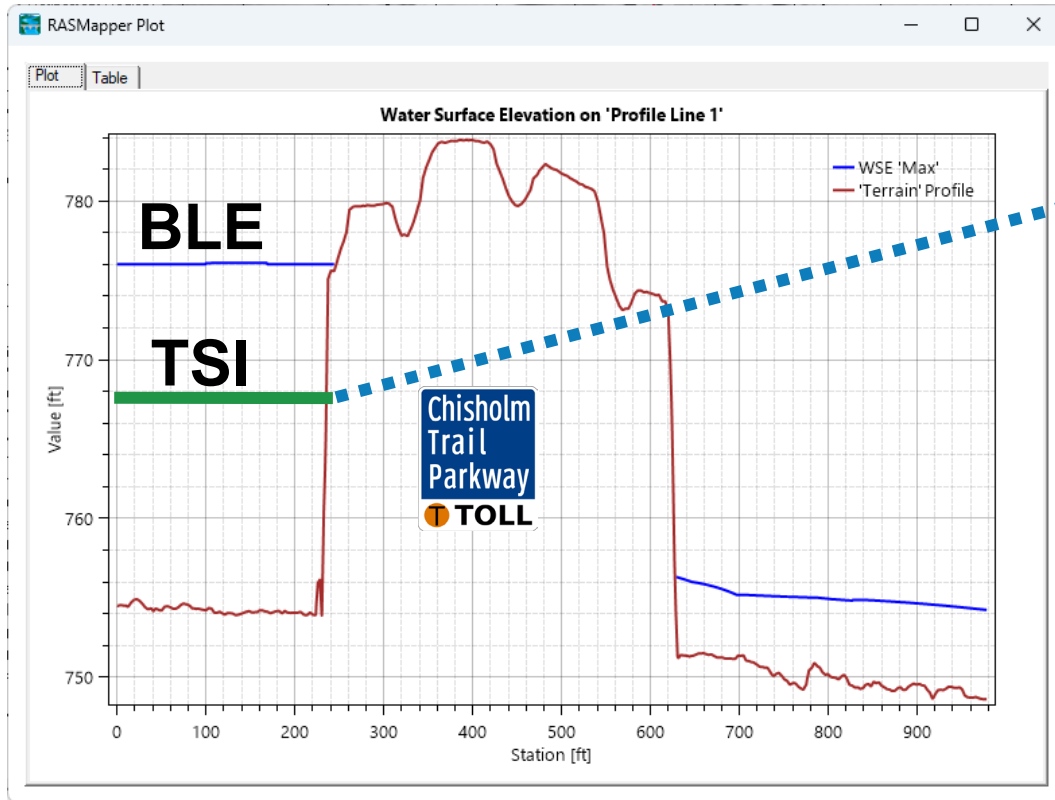
Hydraulic Model Enhancements (2D)

- Culvert through embankment lowered upstream water surface



Hydraulic Model Enhancements (2D)

- Culvert through embankment lowered upstream water surface



Hydraulic Model Enhancements (2D)

- Manning's roughness refined for channel

