

Road Elevation Model



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Center for Water and the Environment
University of Texas at Austin**



**National Geospatial Advisory Council
Dept of Interior, Washington DC
3 April 2024**

Disclaimer: This presentation is informed by research collaborations at the University of Texas with the NOAA National Weather Service, Texas Dept of Transportation (TxDOT), Texas Division of Emergency Management (TDEM), Oak Ridge National Laboratory, ESRI, KISTERS and Ecopia. The views expressed are those of the author alone and do not represent any policy positions of those agencies or companies.

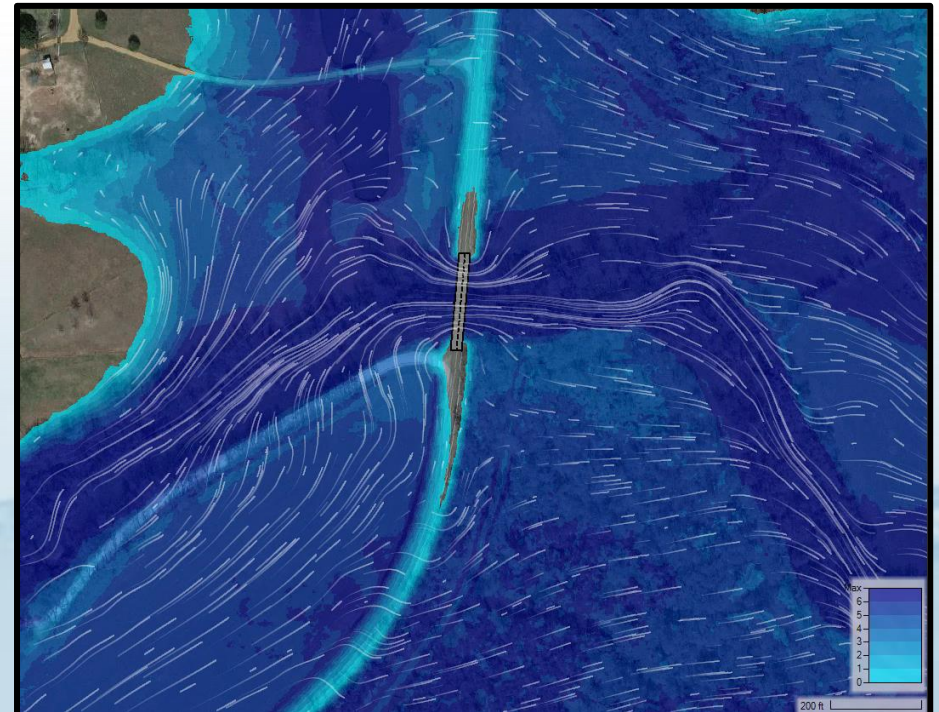
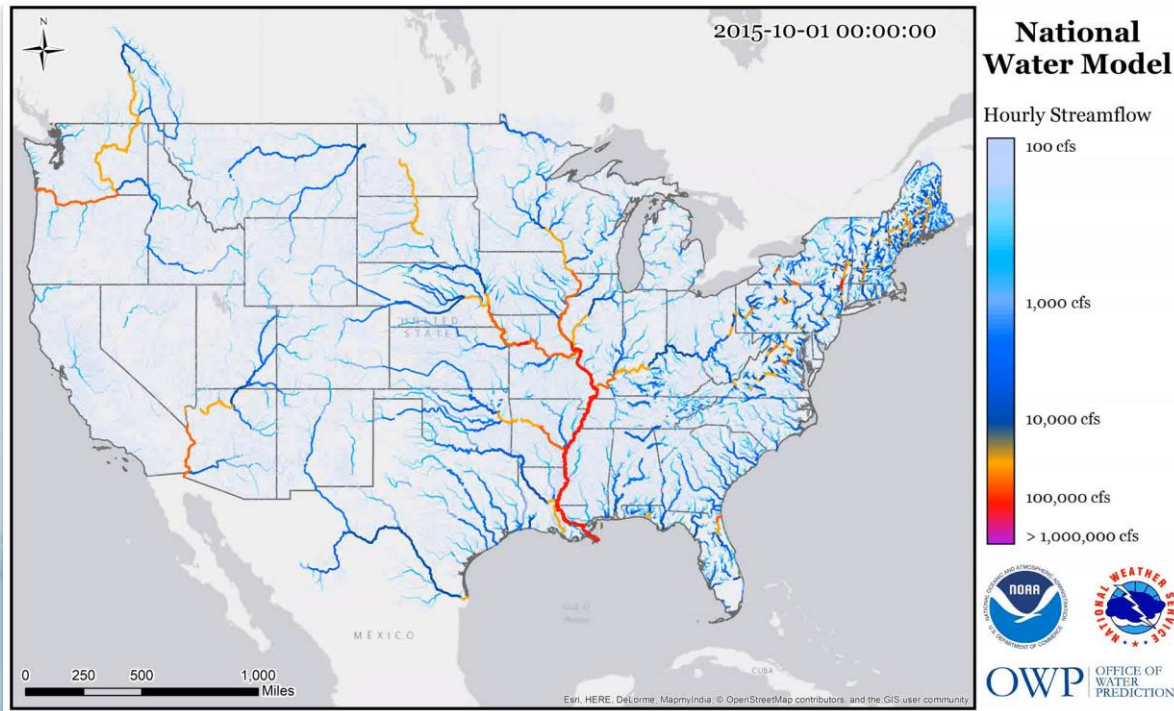
National Flood Forecasting and Flood Impact on Roads and Bridges



<https://water.noaa.gov> Publicly Available: 27 March 2024



National Water Model



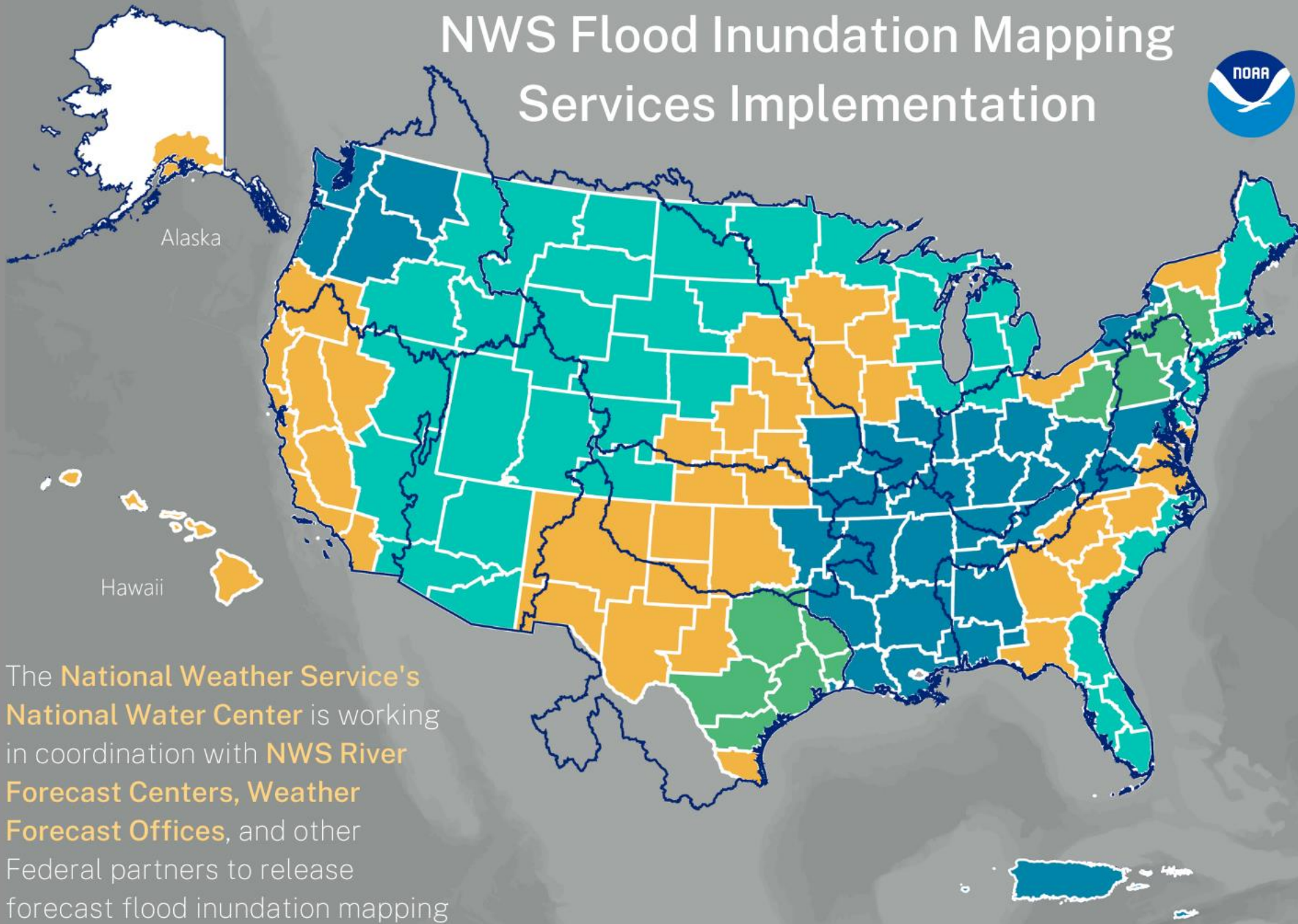


NWS Flood Inundation Mapping Services Implementation

Map Legend



- NWS County Warning Areas
- NWS River Forecast Center Boundaries

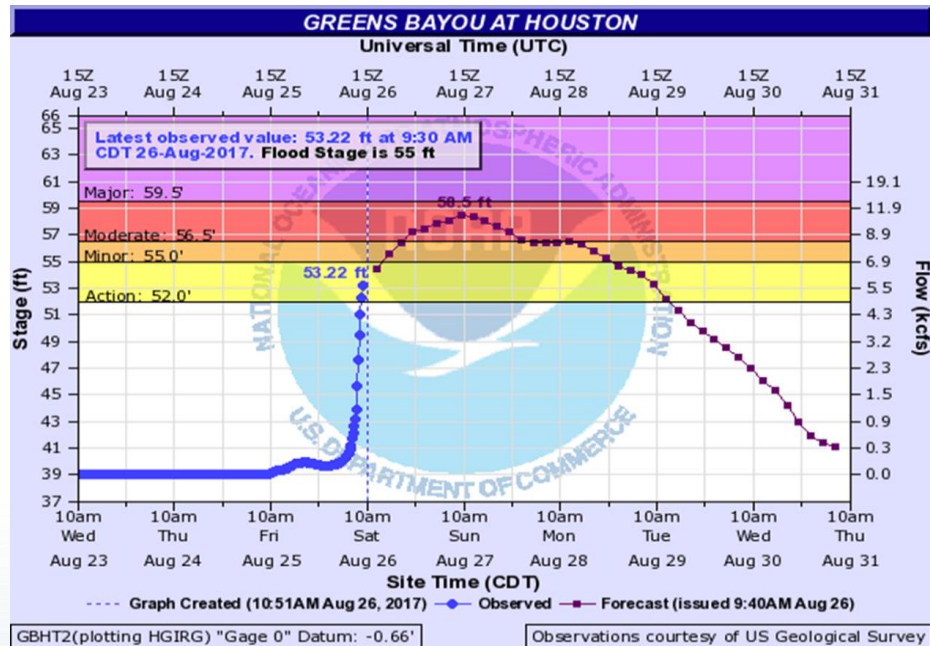


The **National Weather Service's National Water Center** is working in coordination with **NWS River Forecast Centers, Weather Forecast Offices**, and other Federal partners to release forecast flood inundation mapping services to the Nation.

*100% is approximate. Does not include all parts of Alaska, American Samoa, and Guam. Implementation areas are subject to change.

Puerto Rico & U.S. Virgin Islands

Flood Messaging (National Weather Service)



Flood Impacts & Photos Collapse

If you notice any errors in the below information, please contact our Webmaster

- 61 Major lowland flooding continues as homes on Sequoia Bend Drive begin flooding with widespread flooding of homes on McDermott Drive.
- 60 Major lowland flooding continues as homes on McDermott Drive begin flooding.
- 59.5 Major lowland flooding begins as home in Sequoia Estates subdivision begin flooding. Homestead Road south of the channel is inundated with one to two feet of water and water is several feet deep on the south bound feeder of U.S. Highway 59.
- 56.5 Moderate lowland flooding begins as streets in the Sequoia Estates subdivision and west of JFK Boulevard become inundated. The south bound feeder road of U.S Highway 59 is under close to one foot of water.
- 55 Minor lowland flooding begins as water escapes the north side of the upstream bank at U.S. Highway 59. Water is close to inundating the south bound feeder road south of the channel.

“This is a tool we just can’t afford to wait another 5 to 10 years to have...”

— Houston Office of Emergency Management

Flood Inundation Mapping with Hydraulic Models



water surface elevation



road elevation



road flooding

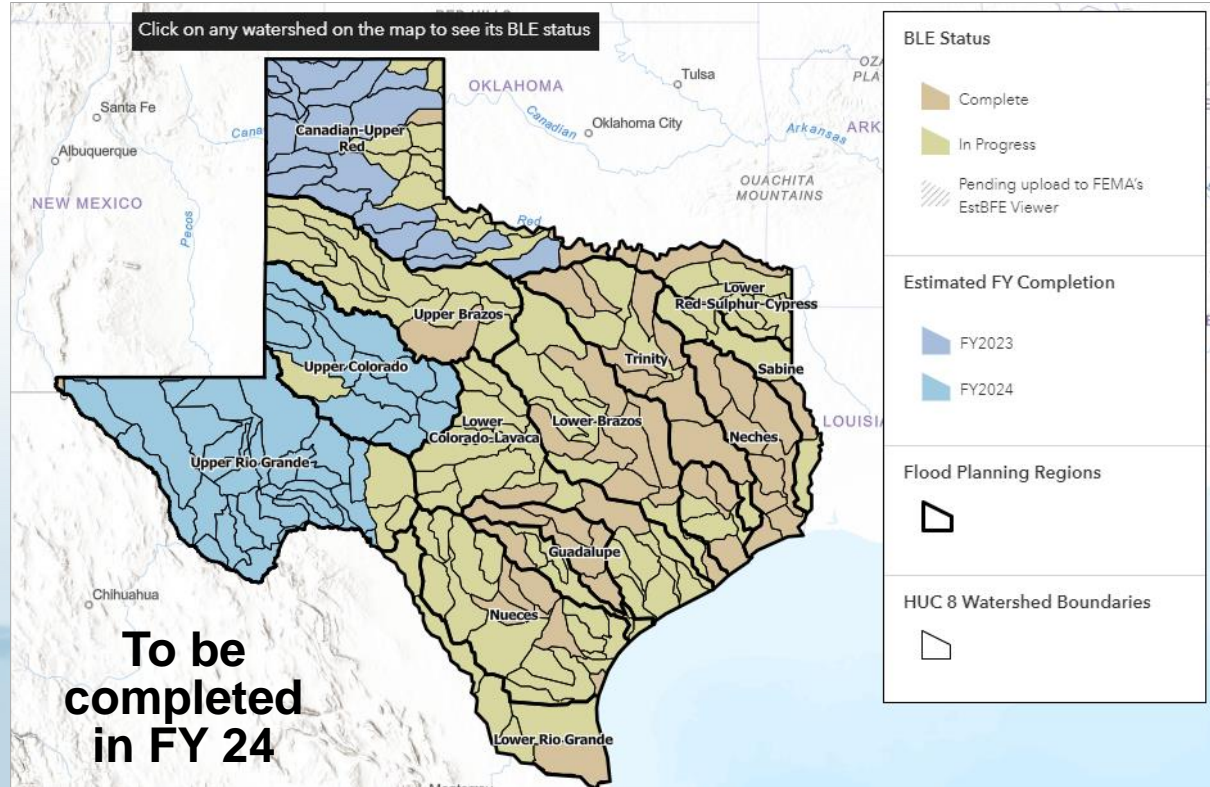


FEMA

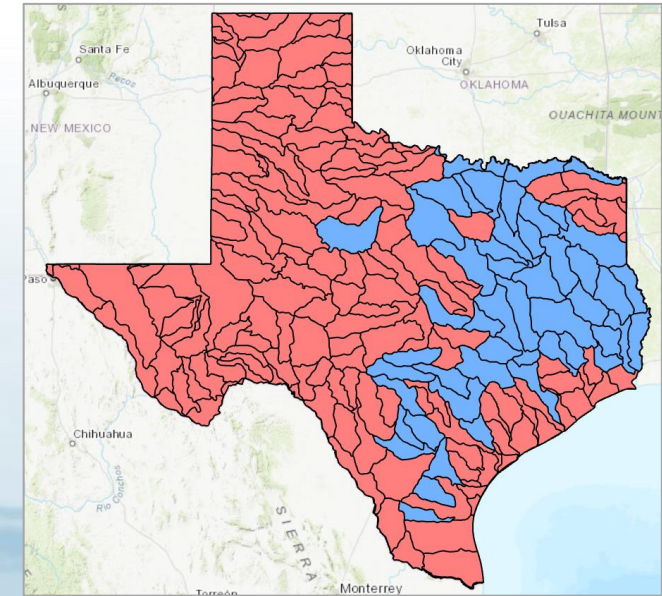
Base Level Engineering Modeling in Texas



\$60 million investment

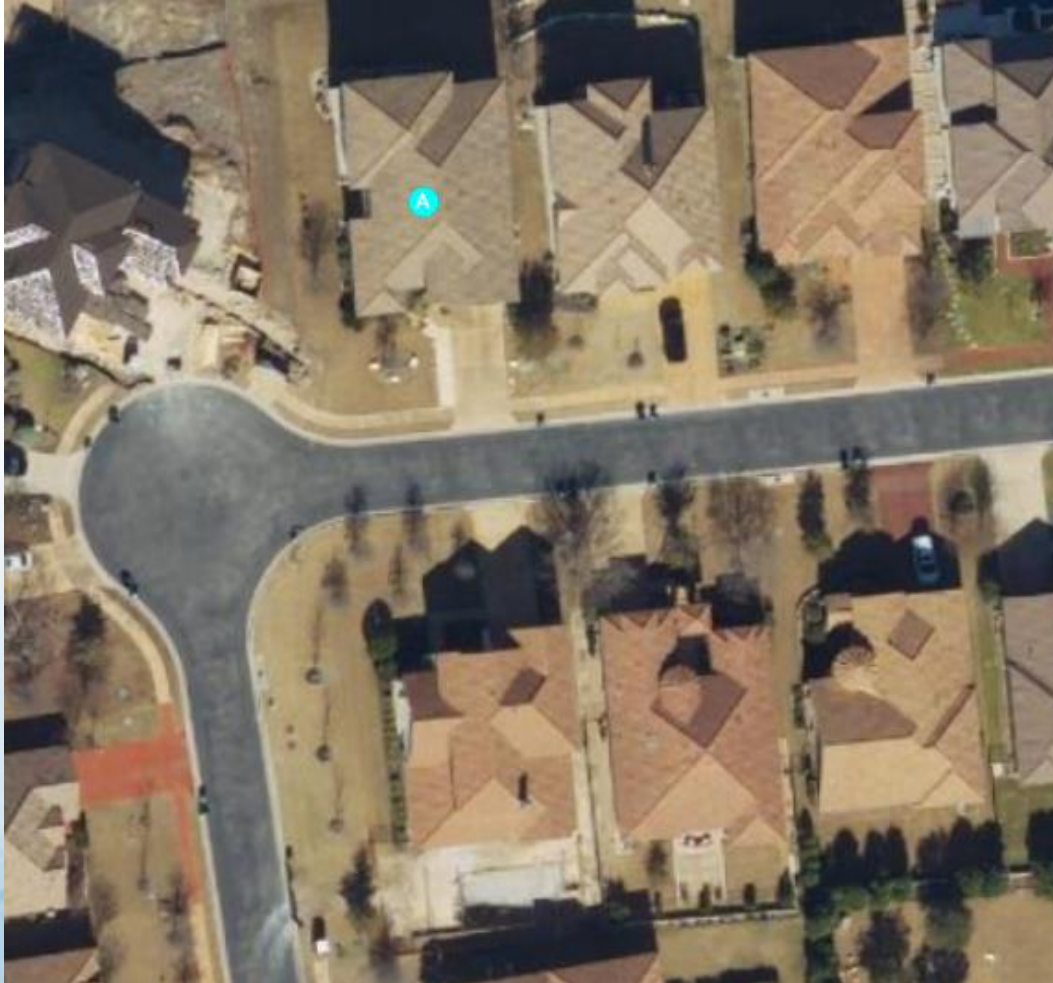


1D
 2D
HEC-RAS



Ecopia Roads at my Home

TNRIS 6" Imagery licensed by TxDOT



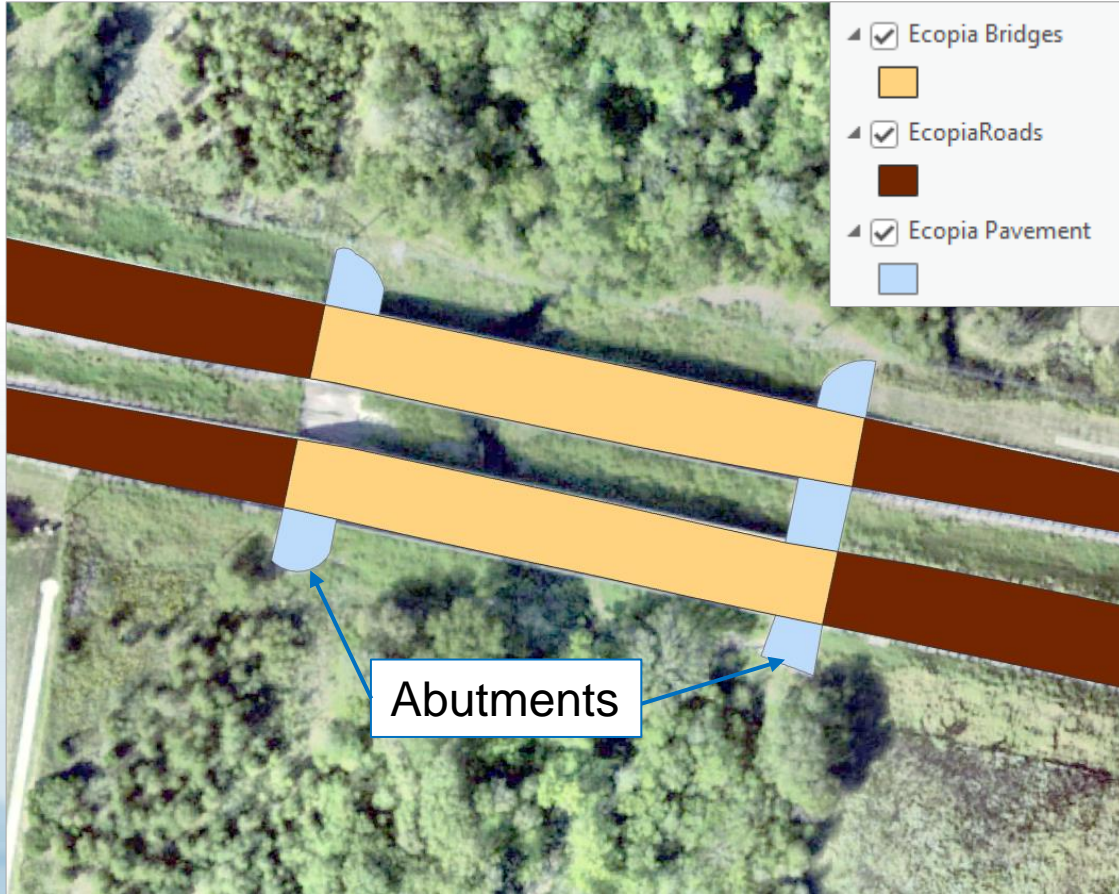
**DIGITIZING THE
WORLD USING AI**

Ecopia Polygons and Centerlines



Road and Bridge Polygons and Centerlines

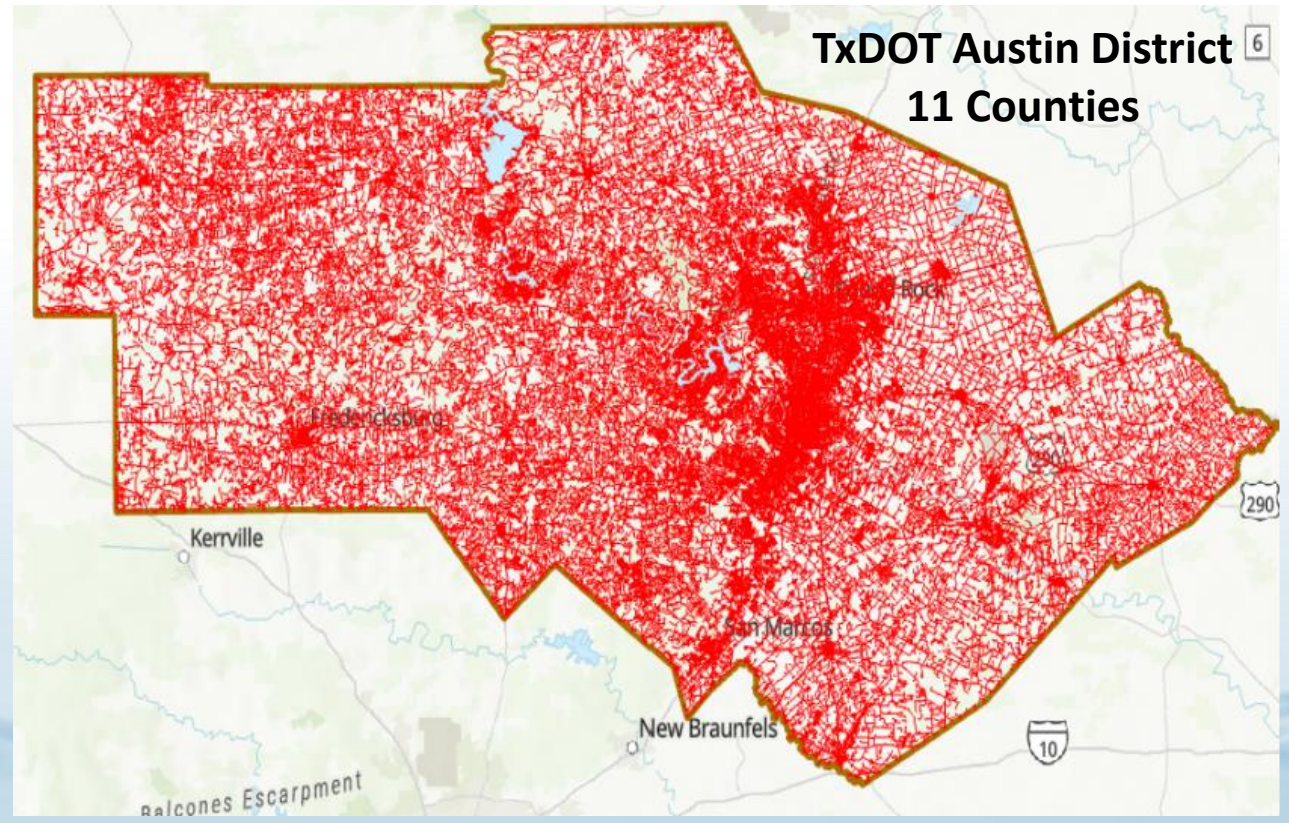
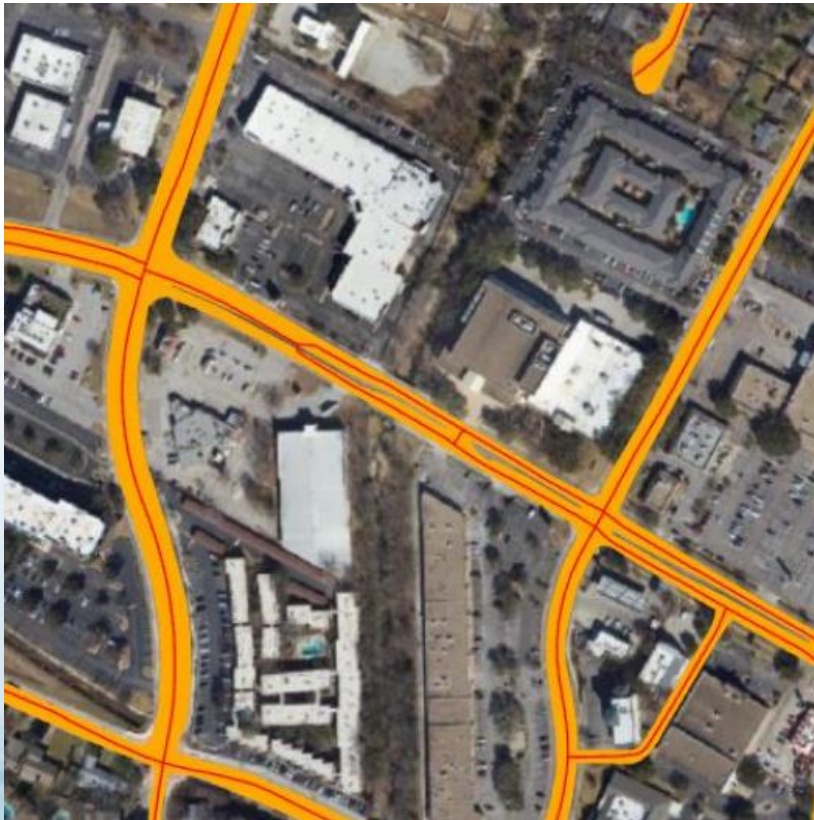
Parmer Lane at Harris Branch, Austin



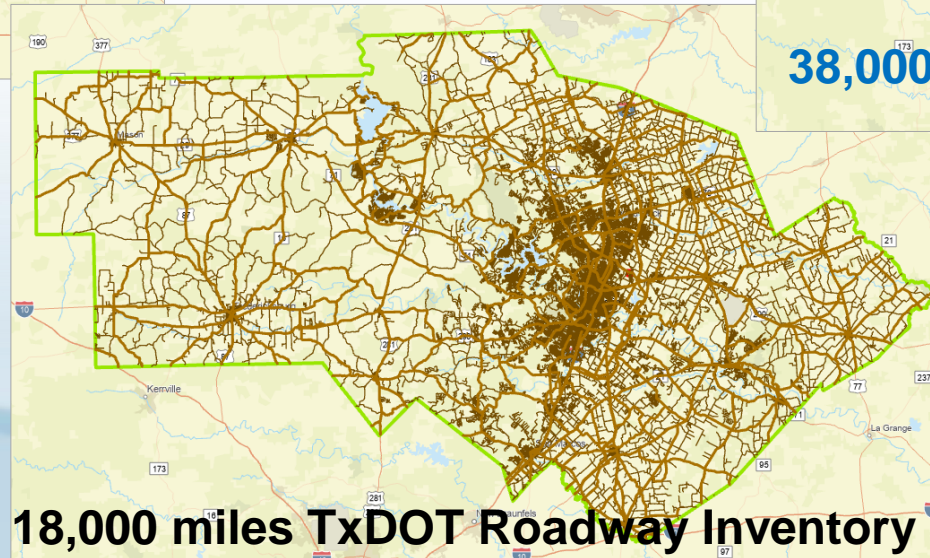
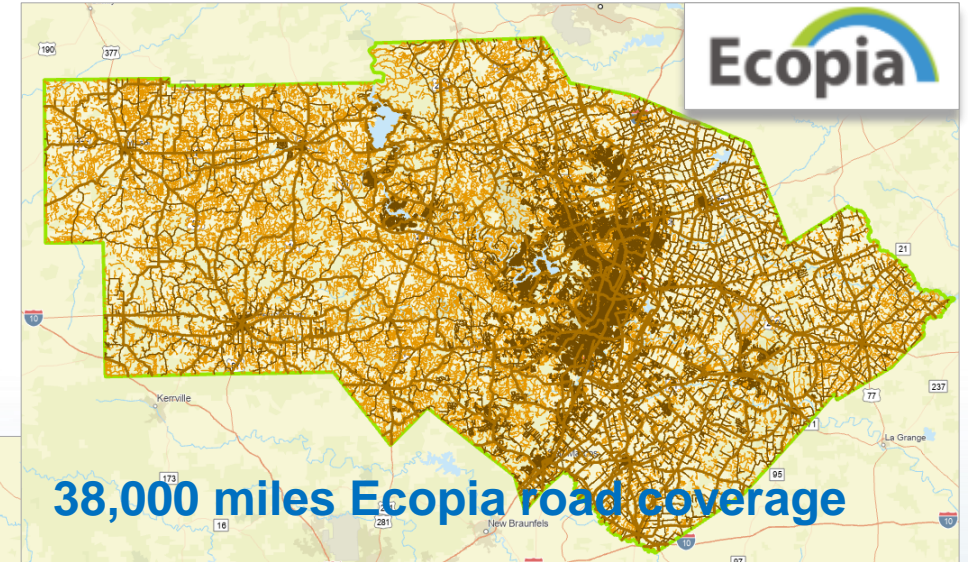
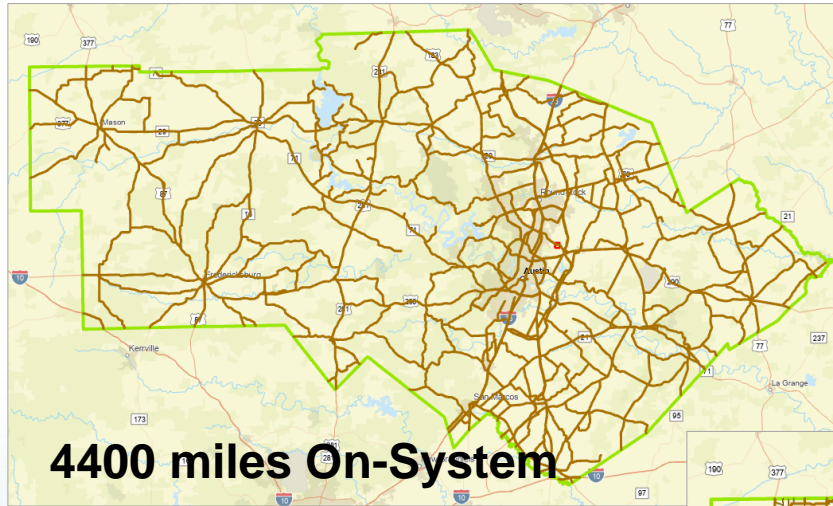
Road Polygon and Centerlines



From AI interpretation of aerial imagery



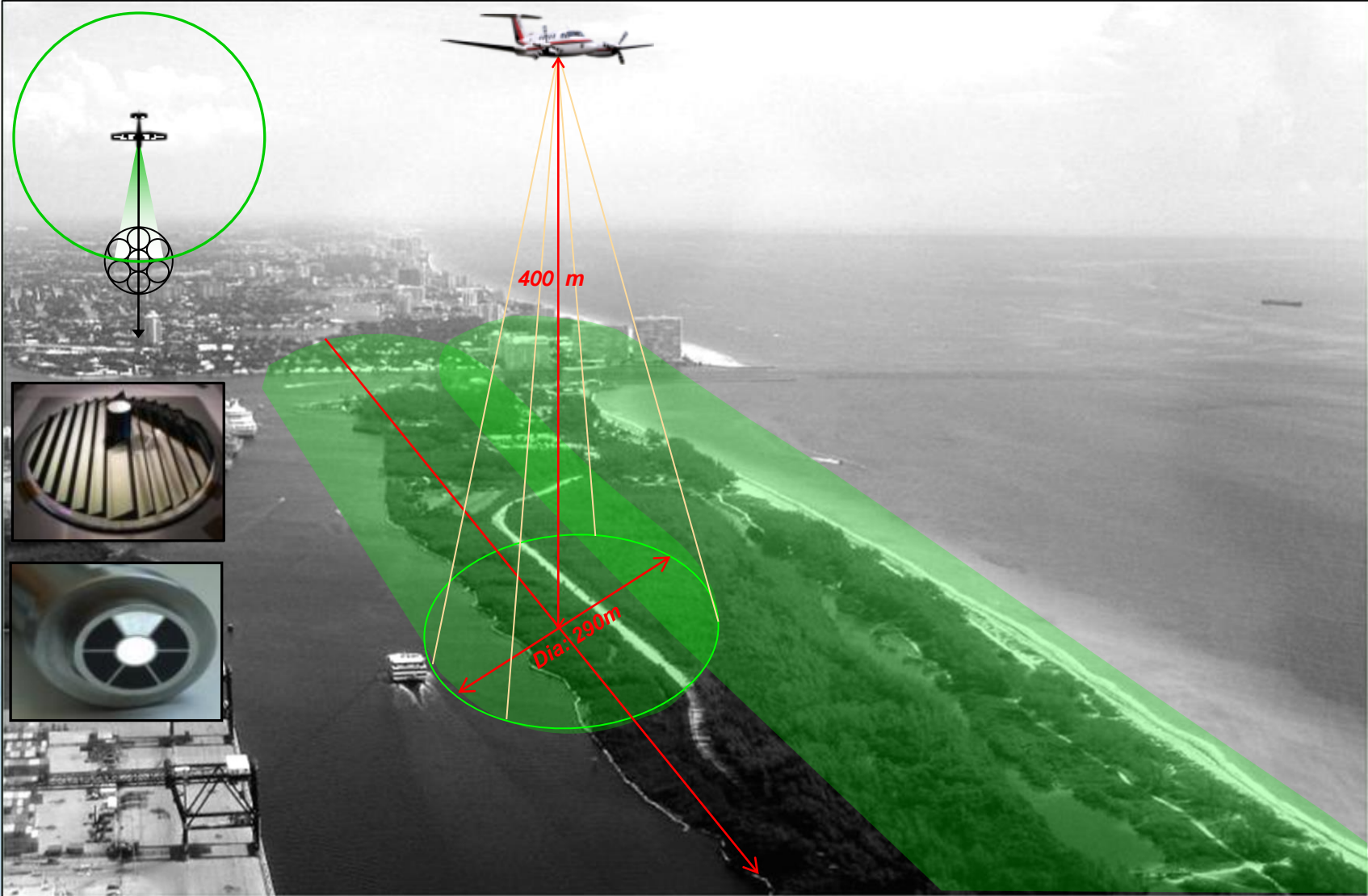
Roads in the TxDOT Austin District



The “Eye in the Sky”
sees all the roads

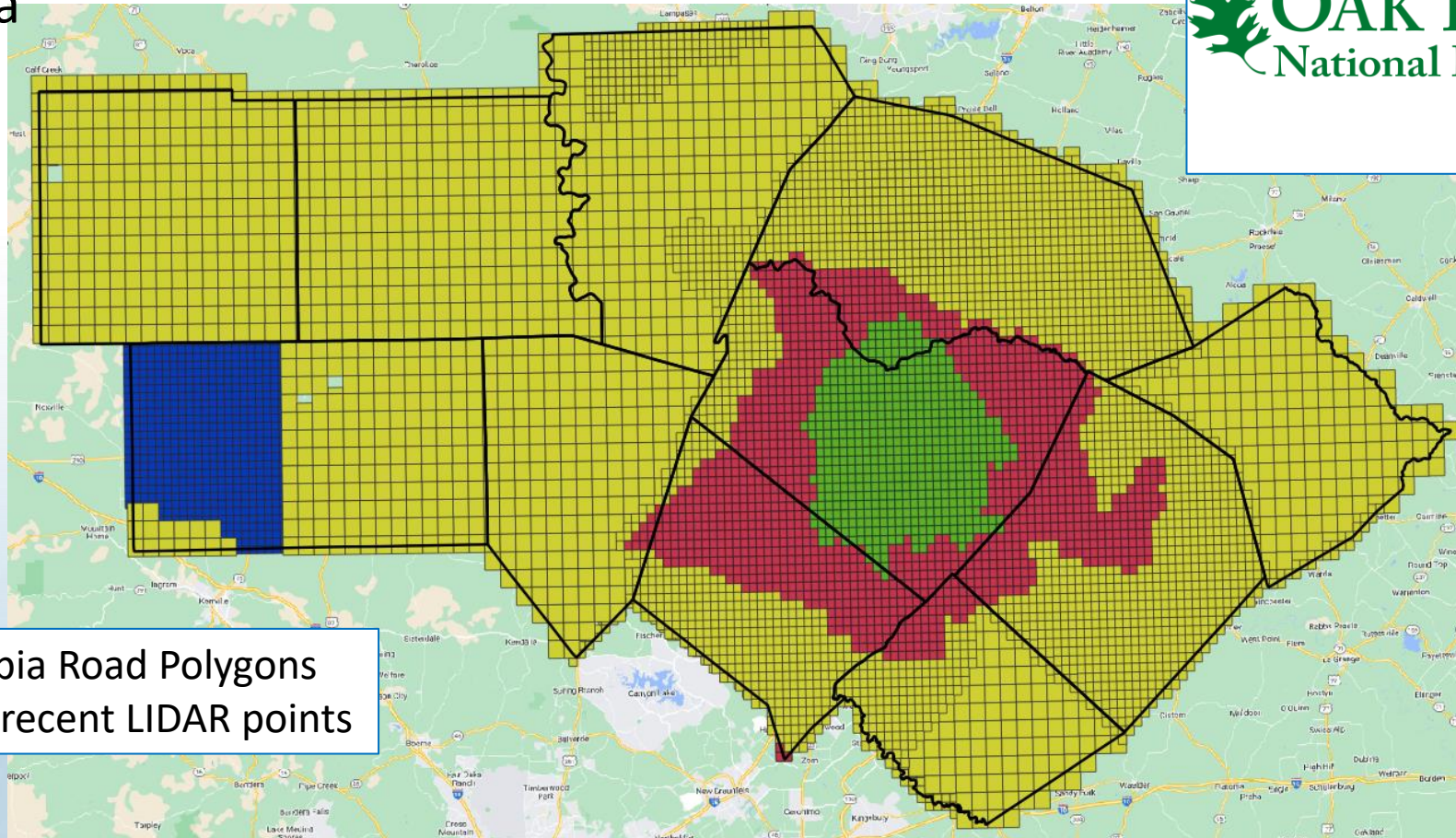
LIDAR (Light Detection and Ranging)

Measurement of Surface Elevation



LIDAR Data Collections for Austin District

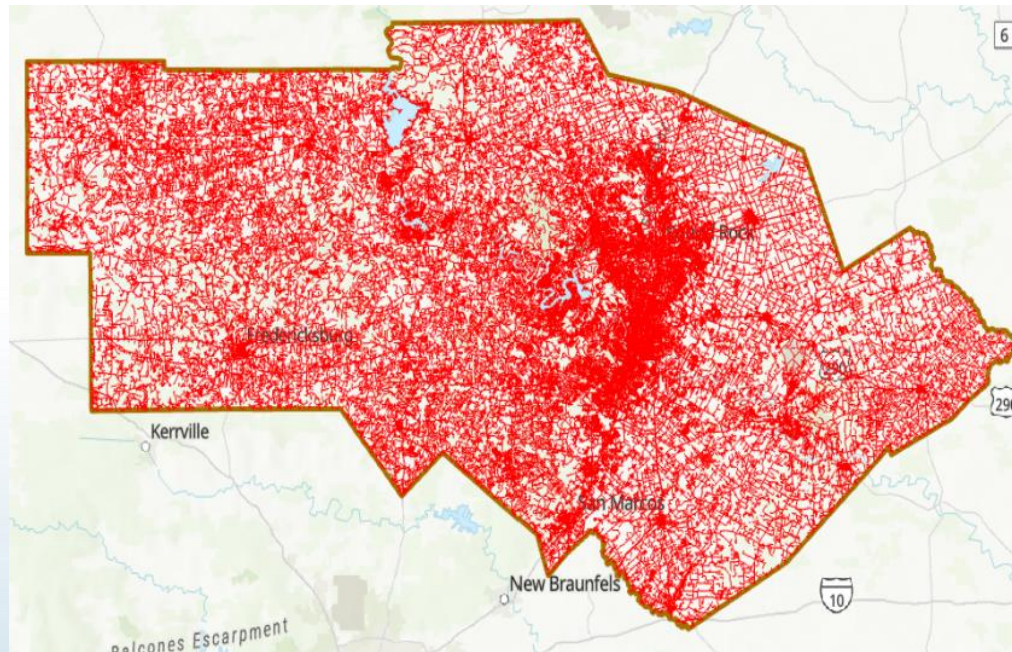
10,012 tiles
1.5 TB of data



Overlay these on Ecopia Road Polygons
and extract the most recent LIDAR points

Austin District Road Elevation Model

https://web.corral.tacc.utexas.edu/nfiedata/road3d/austin_district/AustinMaintenanceSections_H_epsg6343_V_epsg5703/

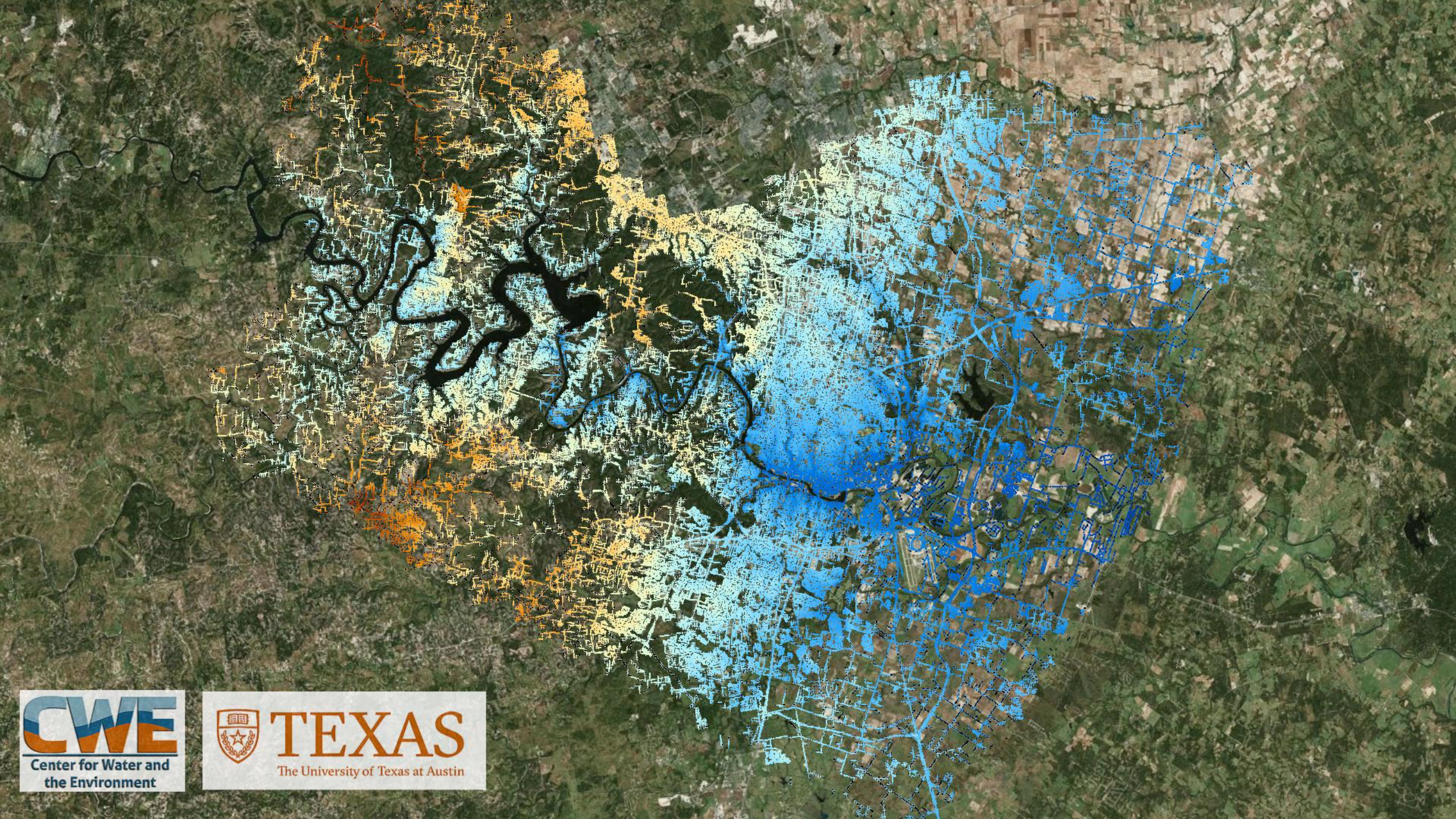


Total Files: 139 GB

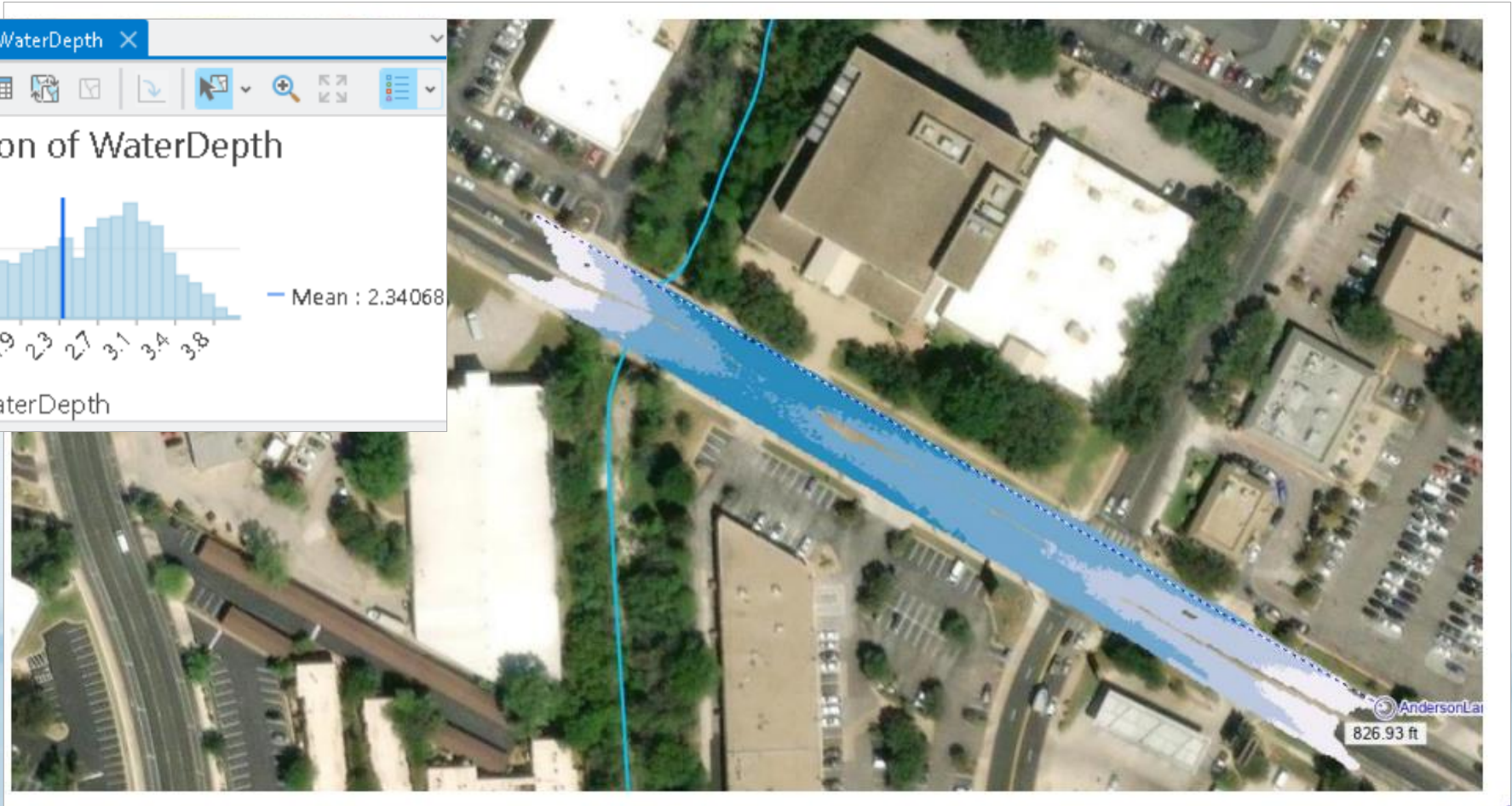
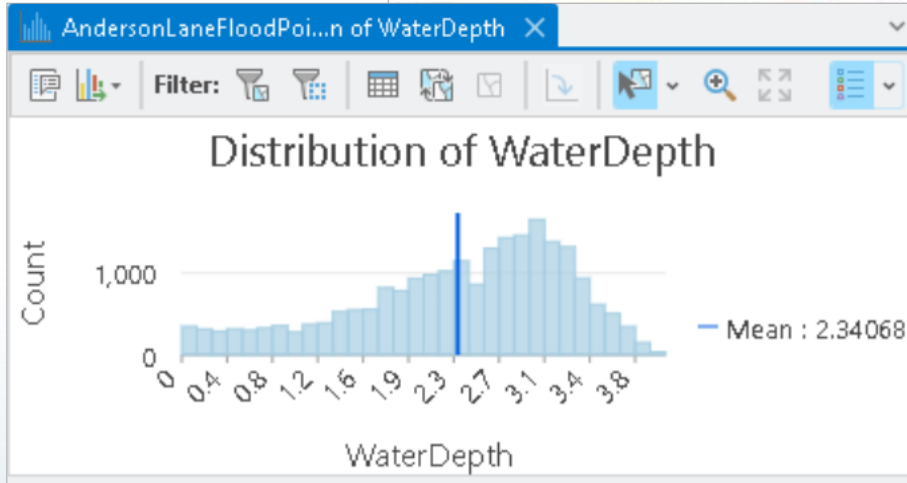
3.8 Billion Elevation Points

Name	Type
Austin-1-Bastrop_County.las	LAS Dataset
Austin-2-Blanco_County.las	LAS Dataset
Austin-3-Burnet_County.las	LAS Dataset
Austin-4-Caldwell_County.las	LAS Dataset
Austin-5-Gillespie_County.las	LAS Dataset
Austin-6-Hays_County.las	LAS Dataset
Austin-7-Lee_County.las	LAS Dataset
Austin-8-Lewis_County.las	LAS Dataset
Austin-9-Llano_County.las	LAS Dataset
Austin-10-Iravis_County_East.las	LAS Dataset
Austin-11-Travis_County_North.las	LAS Dataset
Austin-12-Williamson_County_West.las	LAS Dataset
Austin-13-Williamson_County_East.las	LAS Dataset
Austin-14-Travis_County_Central.las	LAS Dataset
Austin-15-Travis_County_South.las	LAS Dataset
Austin-25-Austin_District_Toll_Roads.las	LAS Dataset

Publicly Available Dataset

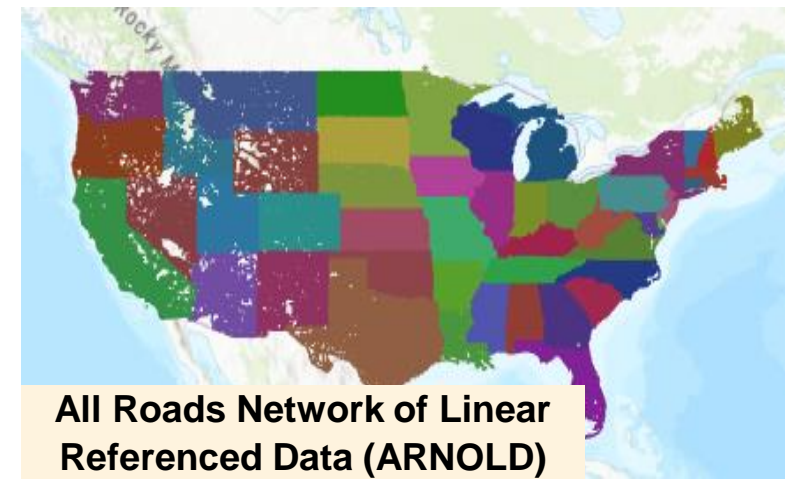


Road Inundation Map using LIDAR Points



Geospatial Road Representation

From location in 3D space to location along the road line



All Roads Network of Linear Referenced Data (ARNOLD)

Road Elevation Model (x,y,z)

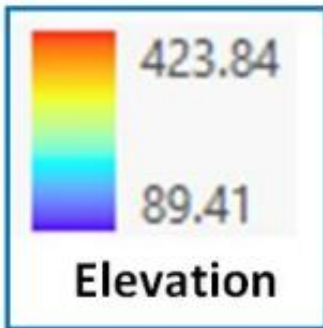


DFO 15.8053 (mi)
to
DFO 15.9533 (mi)
Route Measure

TxDOT Roadway Inventory (x,y,m)

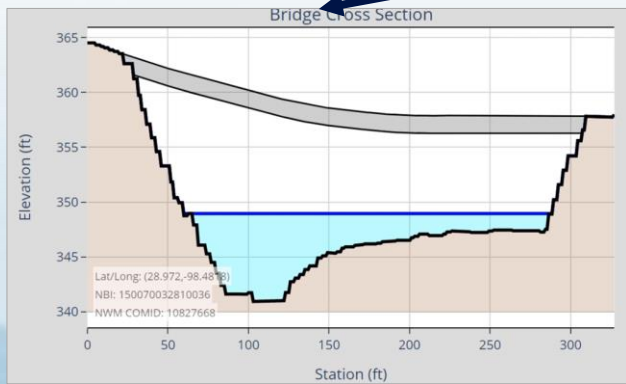
Shape *	Shape_Length	RdWidthFt	InundationAreaSqFt	AvgLengthFt	AvgDepthFt	MaxDepthFt
Polyline M	238.367495	60	48654	811	2.34	4.08

Linear Referencing along Road Line



Road Elevation Model is Foundational

**Road
Elevation
Model**



Span bridges



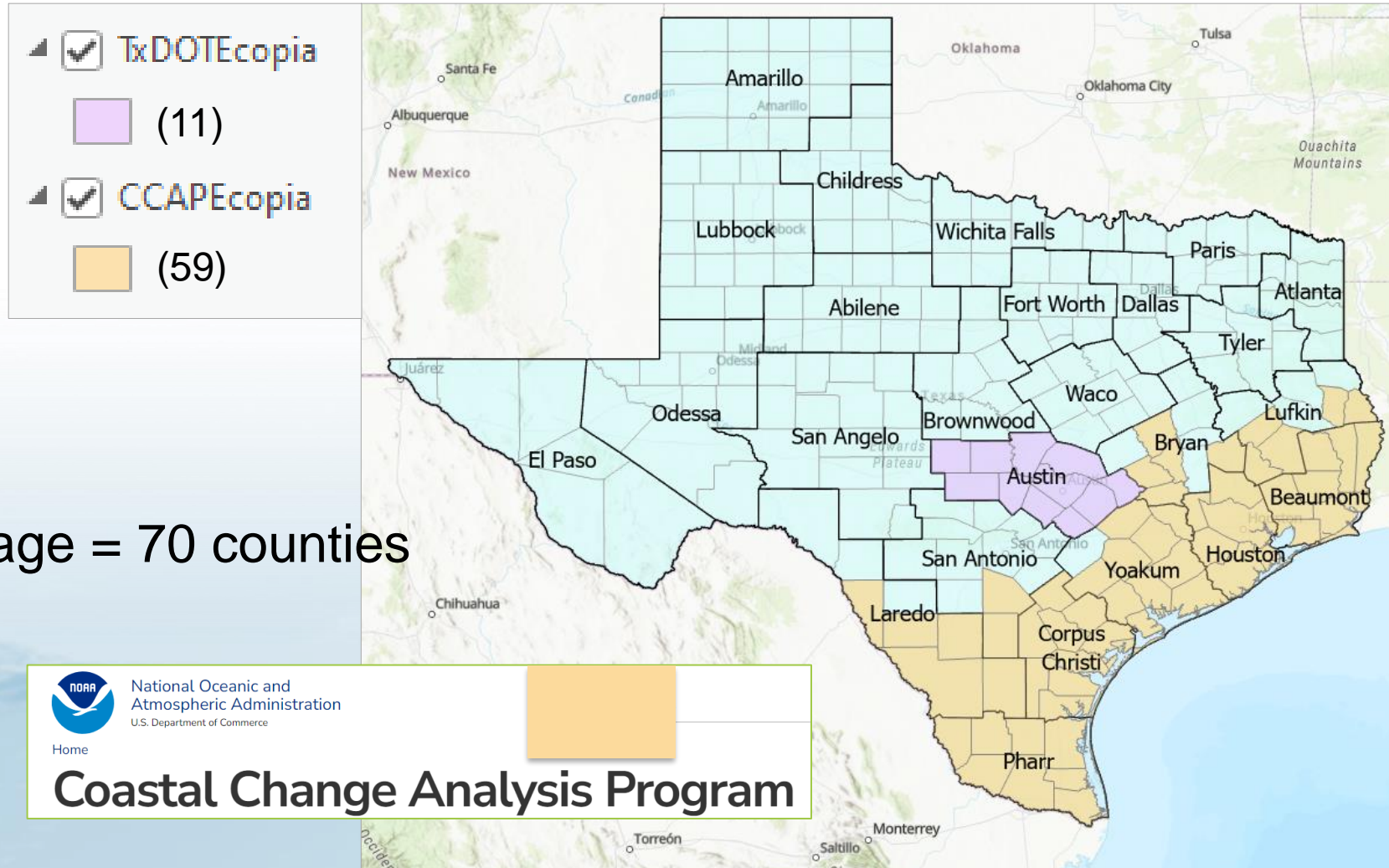
Bridge-class culverts



Low-water crossings

**Road elevation
model provides the
“hanger” for all
drainage structures**

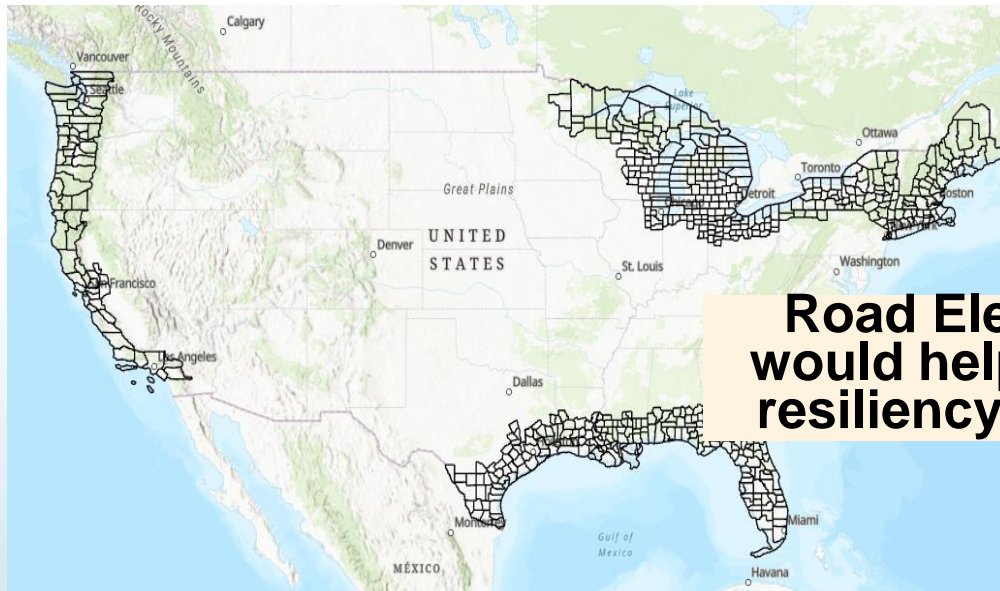
Building Out the Road Elevation Model in Texas



NOAA Coastal Change Analysis Program (C-CAP)

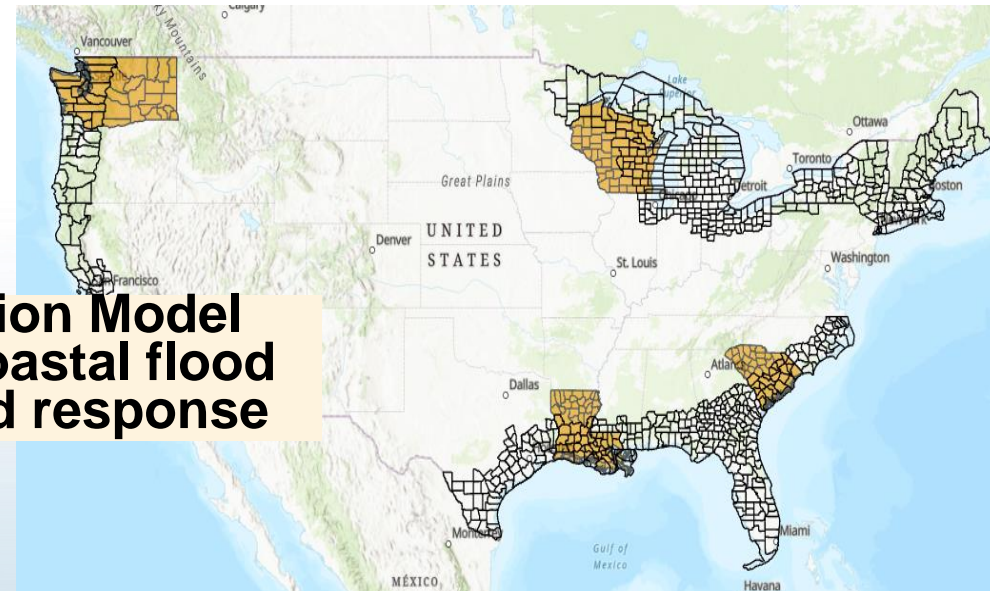
Coverage of Ecopia Data ~ 22% of CONUS plus Alaska, Hawaii and all offshore territories

Coastal Counties



649 Counties

Coastal Counties + State purchases
for WA, WI, LA, SC



649 + 69 = 708 counties total

Road Elevation Model
would help coastal flood
resiliency and response

Total number of counties in CONUS = 3113