

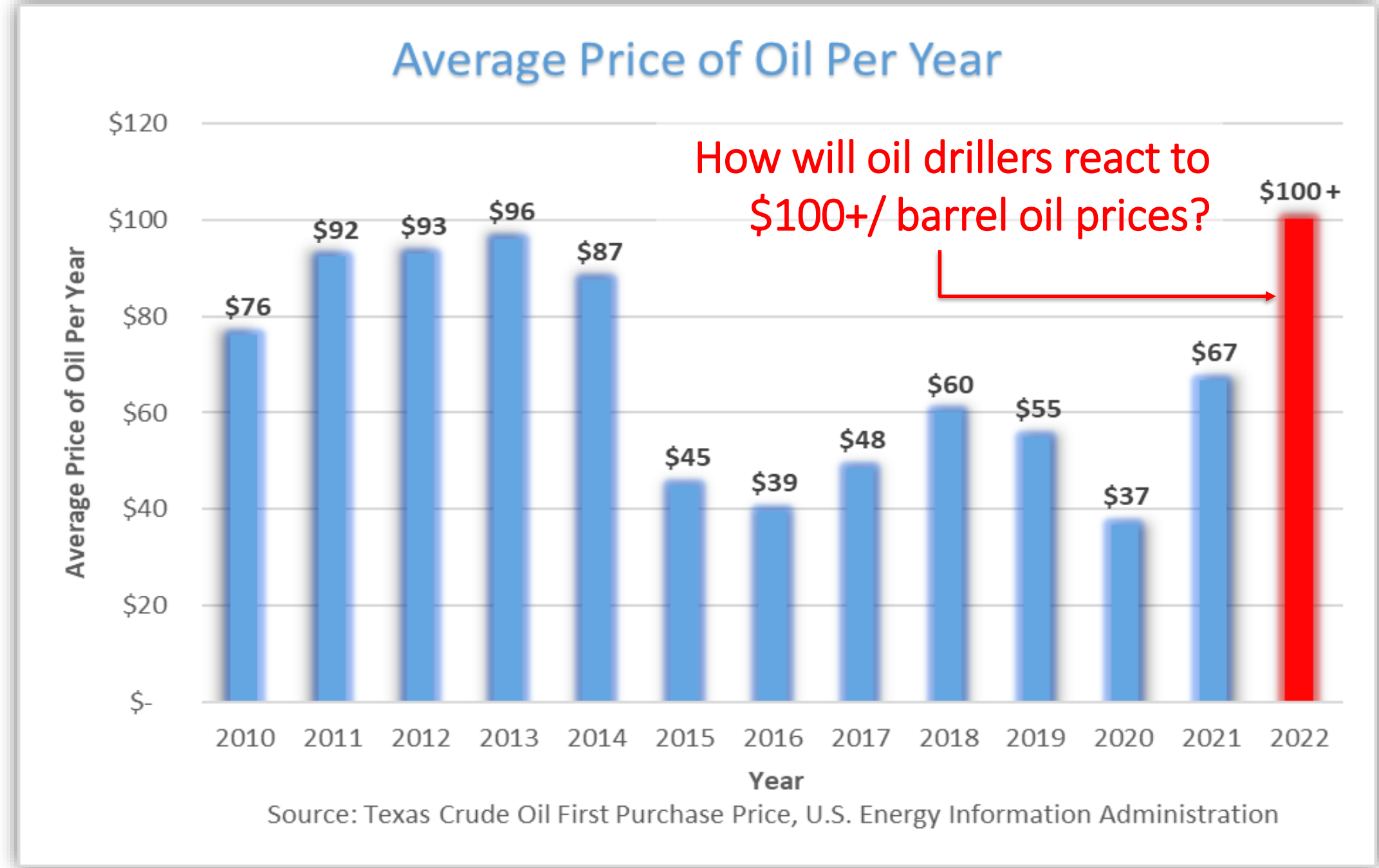
Abstract

Our goal was to develop a GIS-based model to predict unusual pavement wear caused by the heavy pavement loading from oil drilling activities. Forecasting the heaving loading before it occurs gives the district the opportunity to strengthen pavements before the extreme loading occurs. **Proactive pavement strengthening can save up to 90% of the cost of totally rebuilding a pavement after the damage is done.**

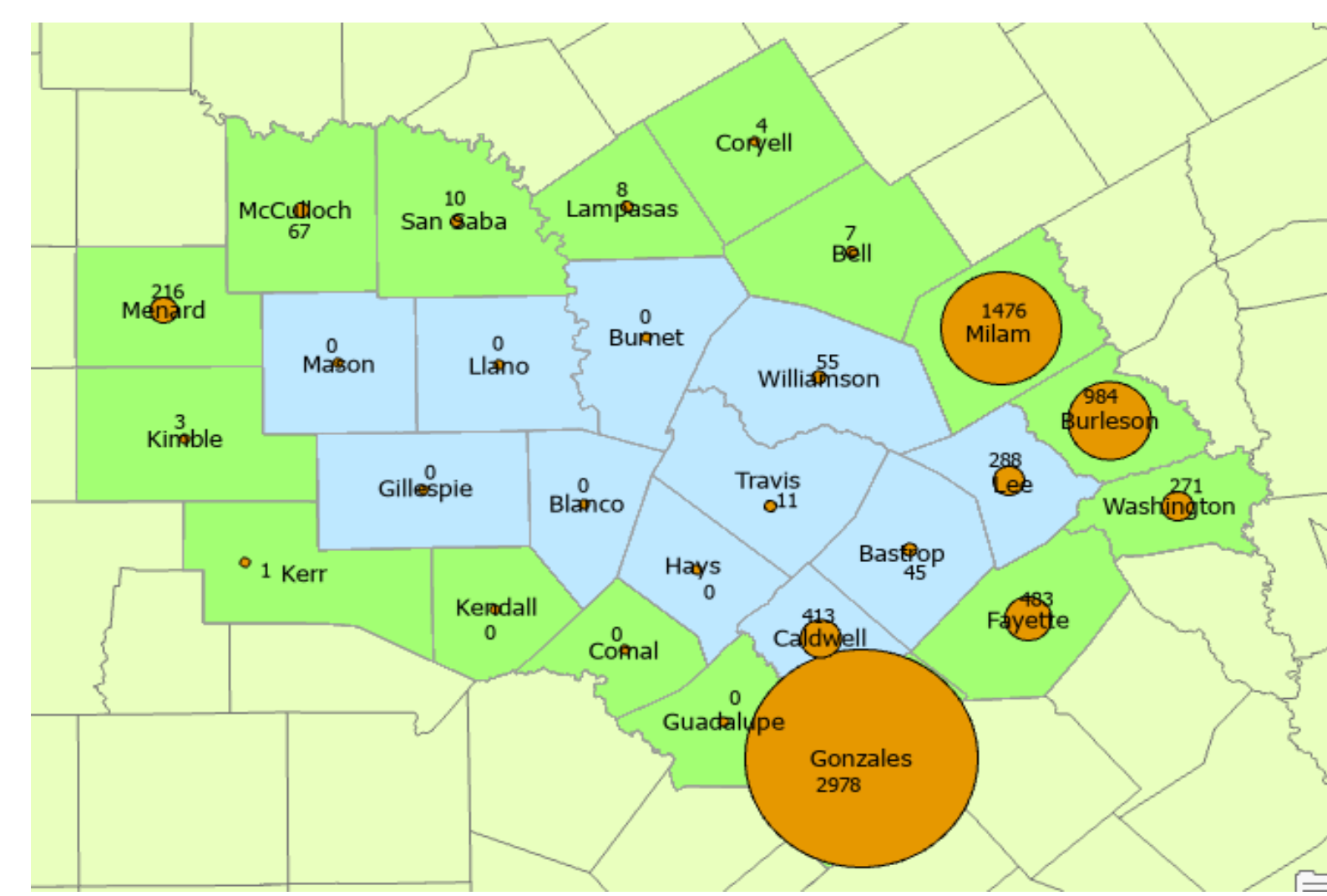
Motivation

Fracking & Effects on Pavement Loading

1. Hydraulic fracturing causes **highly repetitive trips** and loadings are usually concentrated on **low volumes roads** that have **thin pavement structures**
2. Construction phase while shorter than production phase is **much more damaging** to roads (80K lbs trucks: ~1500 water trips, ~800 waste H2O trips)
3. Prices of oil have recently shot up – *what will this mean for TX drilling?*



Drilling in the Austin District



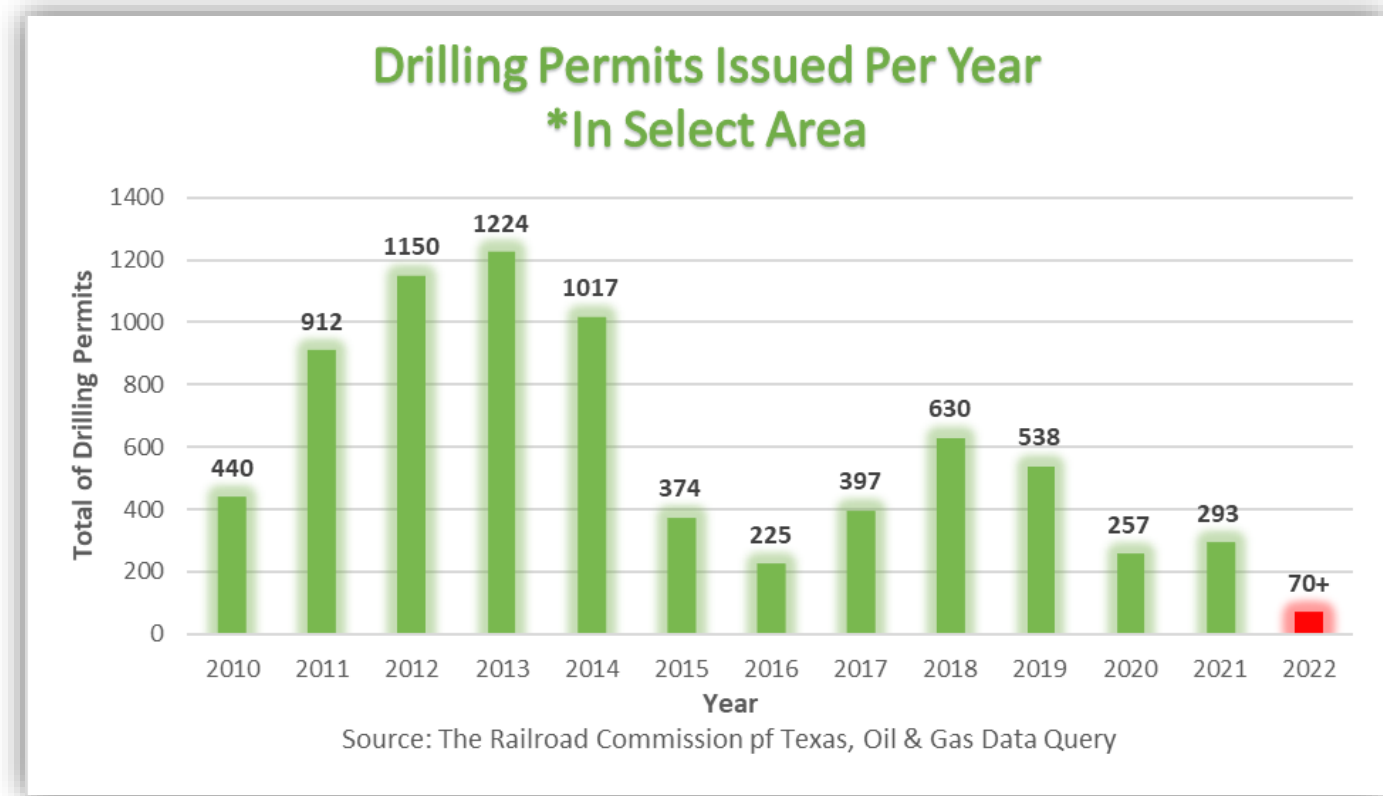
Study Area

Considering activity in surrounding counties → heavy trucks will use roads in the Austin district to complete their trips

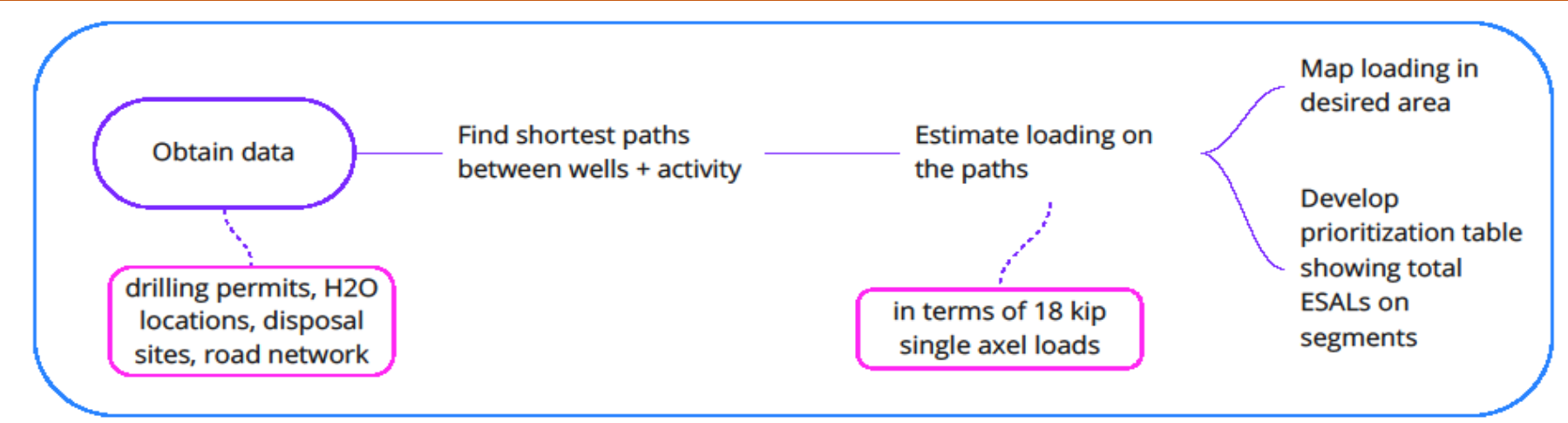
Most permits issued in **Gonzales, Burleson, and Milam**

Drilling Permits Issued

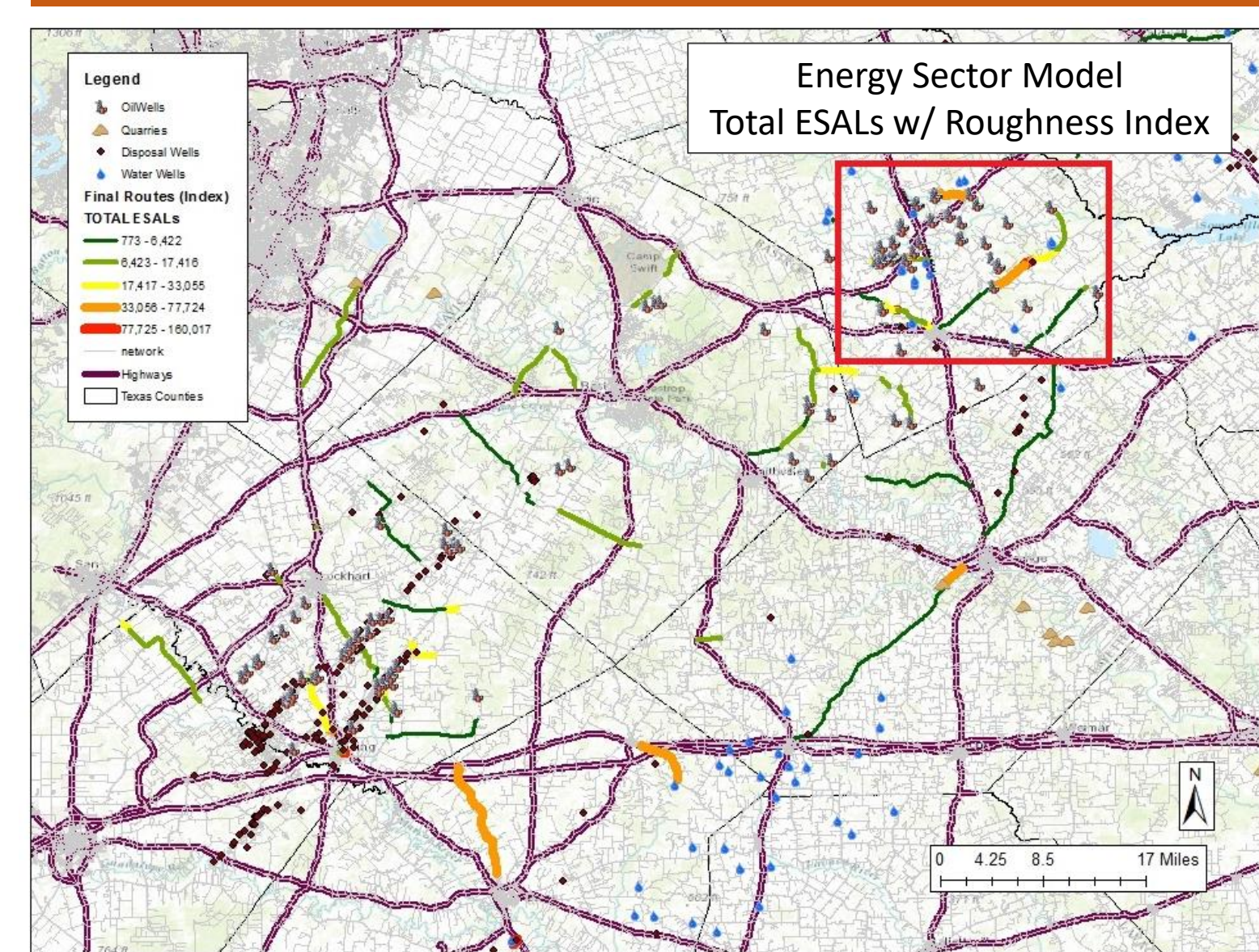
- Permitting activity hasn't been as high as it was pre-2015
- 70+ permits issued Jan-Feb 2022 → already tracking ahead of 2021!
- How will trend continue considering skyrocketing oil prices?



Forecasting Model



Results & Continued Work



Our GIS-based tool has detected over **~8,000 miles of additional loading** that would've otherwise gone unnoticed!

Highway	Miles
FM	5,616.85
US	2,334.31
RM	95.58

Tool can present information as map or tabular data.

An example map showing routes used by oil drilling traffic in the Austin District near Bastrop and Total ESALs.

STNAME	ESAL_CON	ESAL_PRO	TOTESAL	Length	INDEX	Year
US Hwy 190	131296	0	131296	230.593468	36471.11111	2010
US Hwy 190	209253	0	209253	230.593468	58125.83333	2011
US Hwy 190	176429	0	176429	230.593468	49008.05556	2012
US Hwy 190	110781	0	110781	230.593468	30772.5	2013
US Hwy 190	77957	0	77957	230.593468	21654.72222	2014
US Hwy 190	36927	0	36927	230.593468	10257.5	2015
US Hwy 190	12309	0	12309	230.593468	3419.166667	2016
US Hwy 190	8206	0	8206	230.593468	2279.444444	2017
US Hwy 190	12309	0	12309	230.593468	3419.166667	2018

An example table showing Total ESALs from drilling activity for US Hwy 190 between 2010 and 2018.

This effort highlights **heavy trucks** carrying water, materials and equipment both to and from oil and natural gas wells **quickly destroy light duty pavements**, and the importance of tracking these activities.

Acknowledgements

This study builds on previous efforts from the Texas Energy Corridor Analysis project sponsored by Austin District of TxDOT. We would like to thank the TxDOT staff for providing the datasets which allowed us to apply a Python-based Network Connectivity Approach.