TETRA TECH

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2023 Texas Litter Survey

A Survey of Litter At 253 Sites Throughout the State of Texas

PREPARED FOR:

GDC Marketing and Ideation & *Don't mess with Texas*®

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EXECUTIVE SUMMARY

The Tetra Tech project team which consisted of Tetra Tech BAS, Inc., Environmental Resource Planning (ERP) and Carson Consulting, in cooperation with GDC Marketing and Ideation (GDC) and the Texas Department of Transportation (TxDOT), conducted a Visible Litter Survey (VLS) to estimate the number, types and brand names of littered items found along Texas roadways in 2023. The results of this survey were compared to those from the 2013 and 2019 VLS, also conducted by staff from the Tetra Tech project team.

In 2013, TxDOT had requested that two separate litter surveys be conducted within several months of one another and report on the changes in litter found between the two surveys. For 2019, TxDOT requested a single litter survey to be performed with the results compared to the 2013 survey. The 2023 survey subsequently duplicated the single survey approach used in 2019.

In each of these surveys, litter was tallied on 253 sites across Texas, each consisting of a one-tenth mile stretch of TxDOT-maintained roadway. The Tetra Tech project team followed this same approach and methodology for this litter survey. This Executive Summary offers an overview of findings from the 2023 VLS. The full report provides a complete analysis of the data.

Study Highlights

Highlights from the 2023 VLS are shown below. Comprehensive data can be found in the full report and appendices.

- Between 2013 and 2023, Large Litter overall was reduced by 63.2%. The reduction was consistent between all four roadway types.
- Items discarded from motorists accounted for 47% of all litter along TxDOT-maintained roadways.
- Recyclables comprised 38% of Large Litter in 2023 compared to 36% in 2013 and 25% in 2019.
- The largest Large Litter classifications by composition were Plastic (39.2%) and Metal (16.8%).
- In 2023, Beverage Containers were the largest category of Large Litter (29%). Plastic Water bottles (8%) were the most littered type of beverage container.
- Cigarette Butts continued to comprise the largest portion of Micro Litter in 2023 (29%), as was also the case in 2019 (24%) and 2013 (28%).
- ***Given the decrease in Large Litter, and despite increased population and vehicle miles traveled, the Don't mess with Texas® program is likely more effective than is realized.***

1.0 LITTER SURVEY RESULTS

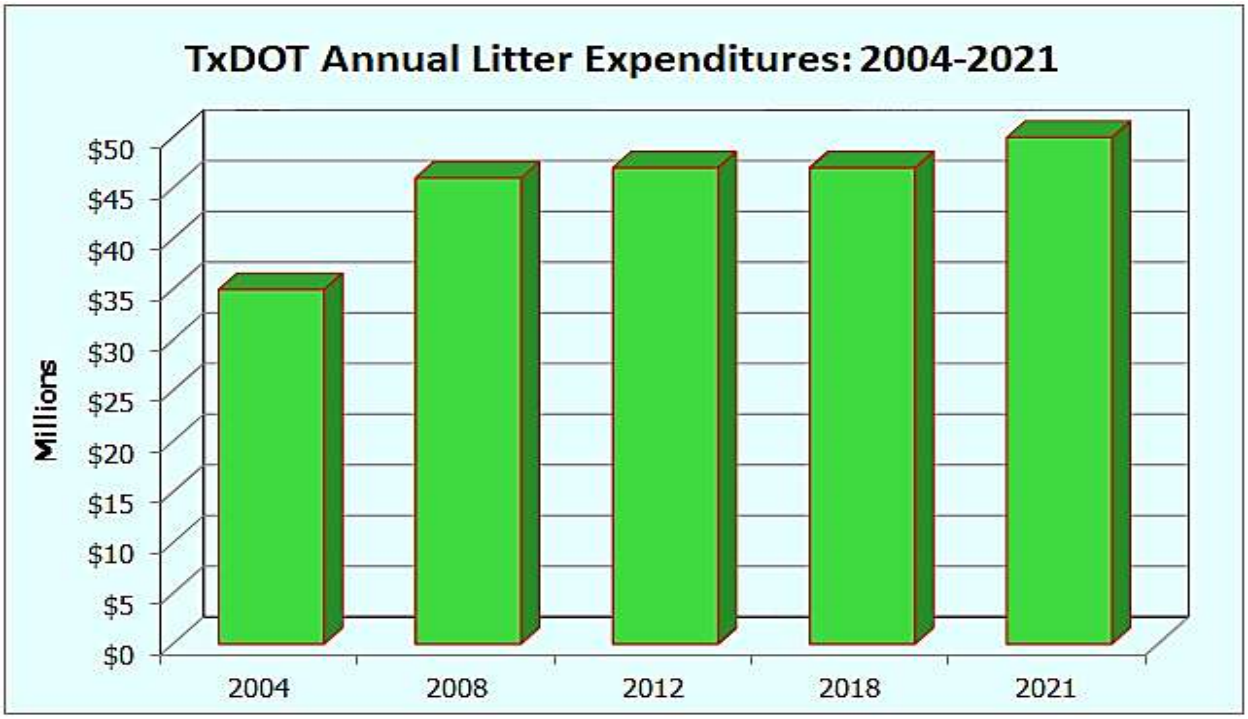
1.1 Introduction

The project team was tasked to conduct a litter survey throughout the State of Texas in 2023 to gauge the rate, extent and composition of litter along roadways maintained by TxDOT and to compare the results of this survey to results of the 2013 and 2019 surveys. TxDOT has sponsored such statewide litter surveys since 1985. The methodology used for conducting these litter surveys has consisted of quantifying and characterizing Large Litter (items two inches and larger) and Micro Litter (items smaller than two inches). It should be noted that in the 2013 and 2019 litter surveys, items two inches or more was referred to as "Visible Litter." However, to avoid confusion with the Visible Litter Survey nomenclature, for 2023, litter two inches or more is referred to as "Large Litter." Items less than two inches is still identified as "Micro Litter."

1.2 Cost of Litter

The cost to manage and remediate roadside litter in Texas, as shown in Figure 1, is substantial, having risen to $50 million for TxDOT as of 2021. Research conducted by the project team shows that cities, counties, educational institutions, non-profits, businesses and other entities throughout Texas likely expend additional resources and capital dealing with litter, and therefore the $50 million number should be considered conservative.

Figure 1 - TxDOT Litter-Related Costs



Source: Source: TxDOT (2023)

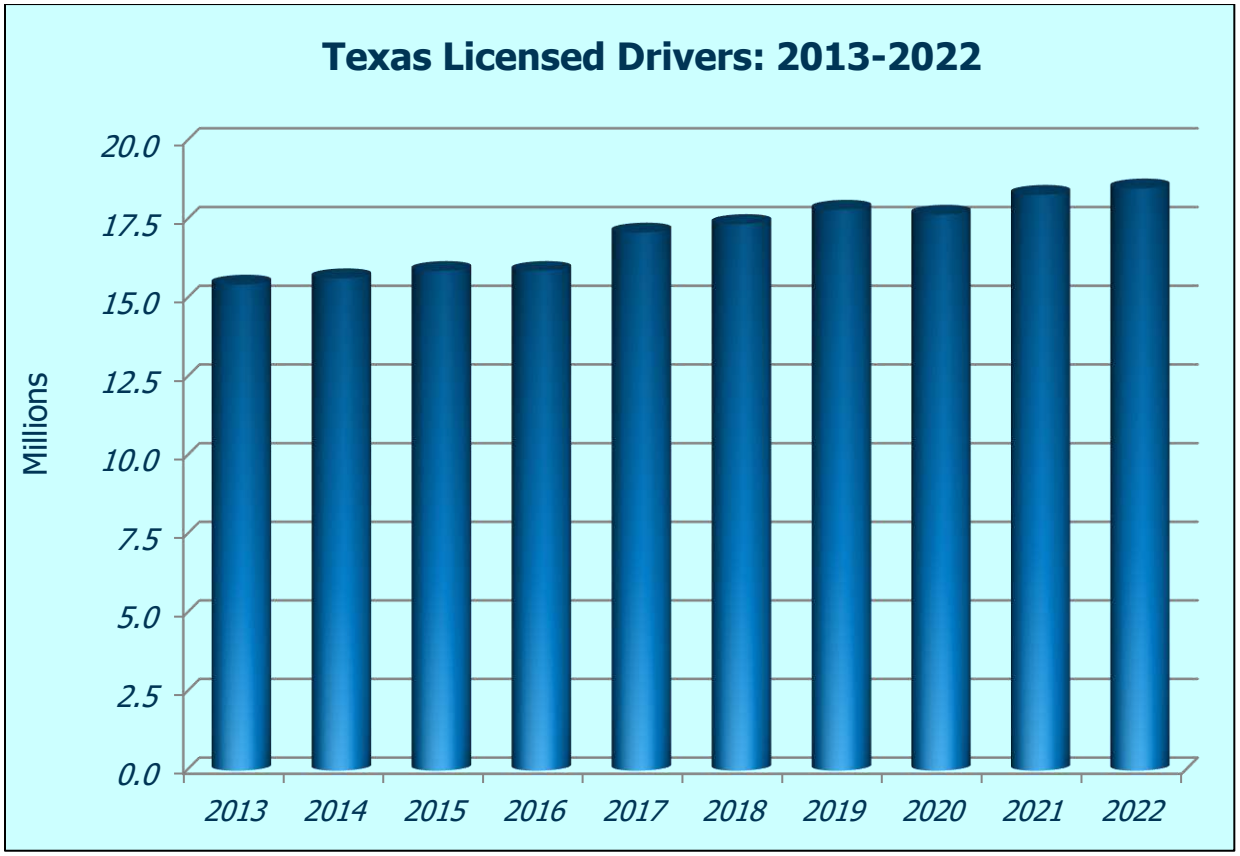
The State of Texas has a significant infrastructure of litter cleanups and educational efforts through TxDOT, Don't Mess with Texas, Keep Texas Beautiful and its local affiliates. The state's Adopt-A-Highway program sponsors cleanups along 10% of Texas roadways.

No other state in the U.S. has consistently surveyed roadside litter and provided high-profile litter abatement programs as Texas has done for more than 35 years and continues to do.

1.3 Licensed Drivers in Texas

The number of licensed drivers in Texas has increased approximately 19.8% between 2013 (15.4 million) and 2022 (est. 18.5 million) as shown in Figure 2. Population growth tends to generate higher traffic levels, which are, in turn, associated with higher rates of littering.

Figure 2 - Texas Licensed Drivers: 2013 - 2022



Source: TxDOT (2023)

1.4 Miles Traveled

Daily Vehicle Miles Traveled (DVMT) measures the average daily traffic on TxDOT- maintained roadways. Increases in DVMT also tend to correlate with higher rates of littering.

During the period 2013-2021, every roadway type showed an increase in vehicle traffic levels as shown in Table 1-1. While US Highways showed only a single-digit percentage increase. All other roadway types showed double-digit percentage increases.

In terms of miles traveled, interstates showed the largest increase, while State Roads and Farm to Markets/Ranch to Markets (FM/RM) roads also increased substantially.

Overall, the traffic levels statewide increased by 74.1 million miles per day (14.8%) between 2013 and 2021 as shown in Table 1-1. This equates to an increase of almost 30 billion miles traveled annually. This 14.8% increase was less than the 19.8% increase in the number of licensed drivers in Texas, suggesting slightly less travel on a per capita basis. This is not surprising since traffic levels have lessened in some areas due to the rise in employees working from home over the past three years. In addition, the Covid-19 pandemic may have played a role in the lower travel rates.

Table 1-1 - Daily Vehicle Miles Traveled

Roadway Type	2013	2021	Increase	% Increase
IH Highways	169,650,462	201,595,992	31,945,530	18.8%
US Highways	108,823,518	114,896,508	6,072,990	5.6%
State Roads, Business Rtes.	116,512,785	136,440,384	19,927,599	17.1%
FM/RM Roads	71,448,225	82,653,867	11,205,642	15.7%
Pass, Park & Recreation Roads	810,678	1,069,639	258,961	31.9%
Frontage Roads	32,621,931	37,319,735	4,697,804	14.4%
On-System Subtotal	**499,869,612**	**573,978,146**	**74,108,527**	**14.8%**

Source: TxDOT (2023)

2.0 METHODOLOGY

The 2023 Texas Litter Survey surveyed the same 253 locations that were surveyed in the 2013 and 2019 litter studies, with one caveat. As was true in 2019, roadway construction, accidents, unforeseen manmade or natural barriers and other issues precluded surveying at certain sites. In those cases, the closest areas that was safe to survey was selected as a substitute and documented accordingly.

Field crews again surveyed more than 2.4 million feet along Texas roadways as they had in 2019. Litter was classified as either Large Litter (two inches or more) or Micro Litter (less than two inches). All sites were one-tenth mile in length and 18 feet deep.

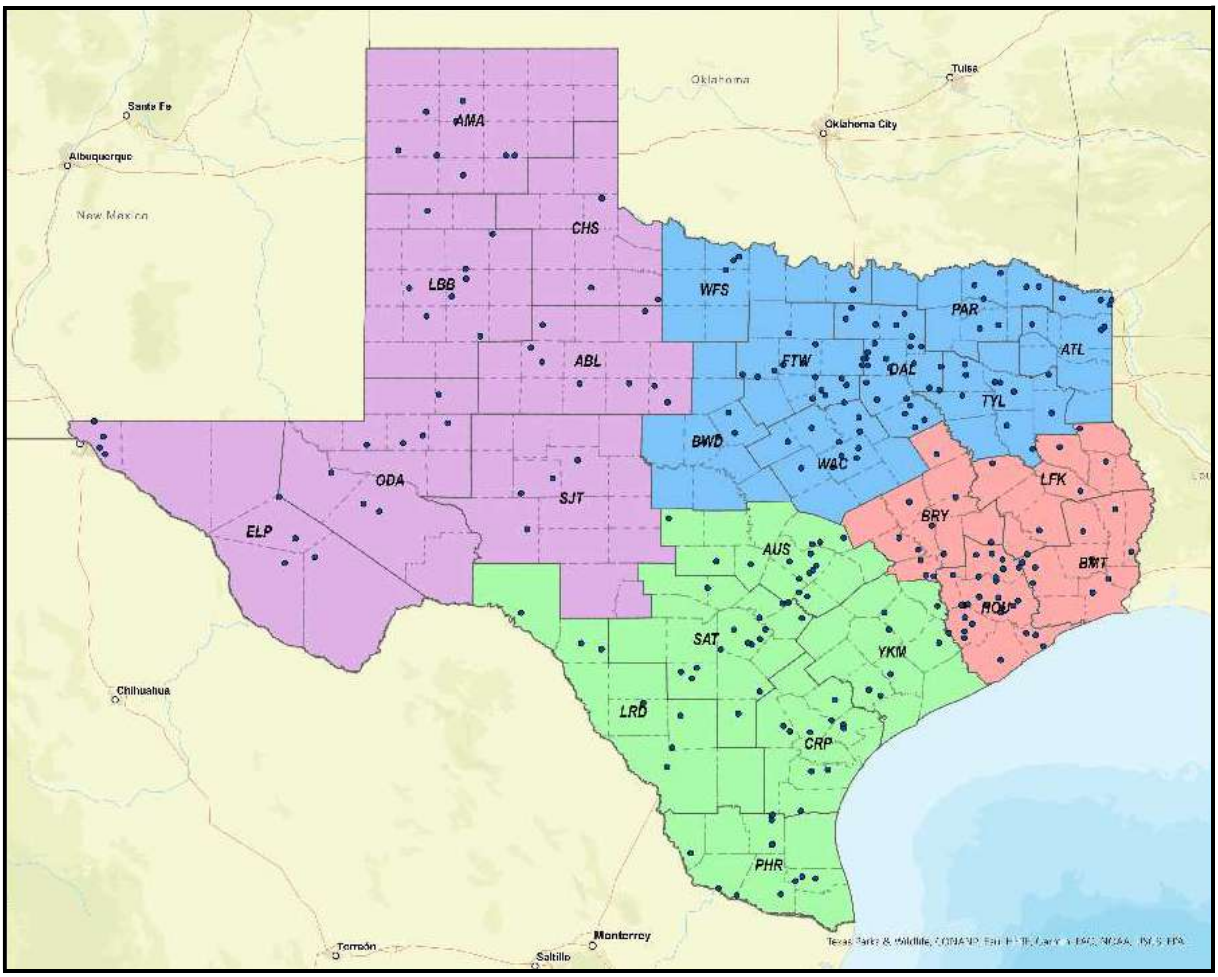
Large Litter was sampled on the entire site, while Micro Litter was sampled on three transects within each site. Each of the three transects comprised a 3' x 18' area. The area of the three transects totaled 162 feet. For each site, the data from these three transects were extrapolated to the size of the entire site.

The following approach was used for conducting the 2023 litter survey:

1. Quantifying and characterizing roadside litter,
2. Analyzing the data, and
3. Evaluating changes in the tallies and types of litter observed between 2013, 2019 and 2023.

Brand names of items were recorded when visible. The map in Figure 3 shows the color-coded locations of the 253 sites. Of these, 163 were used in studies prior to 2013, while 90 new sites were added by TxDOT in 2019 and have been included in all subsequent litter surveys. The Sites Distribution Map in its entirety, as well as individual site maps by region are provided in Appendix D.

Figure 3 - Sites Distribution Map



2.1 Components and Categories

Litter was characterized using 251 components (185 for Large Litter and 66 for Micro Litter). These components were subsequently rolled up into 10 major categories of litter as shown below and are comparable to those used in previous Texas litter surveys. All components were classified by material type as well.

1. Beverage Containers: 18 individual components including beer, soda, sports and energy, water, wine and liquor, juice, and tea. Six-pack rings are also included.
2. Cup-Related: cups used solely for hot drinks, cups used solely for cold drinks and lids found without cups. Also included are straws and wrappers because they are directly related to drinking cups.

4. Snack Wrappers: sweet snacks (candy, cakes), salty snacks (chips, crackers), and gum.
5. Paper: all non-food/beverage paper items including newspapers, magazines, flyers, lottery tickets, business, school, receipts, packaging, paperboard, corrugated boxes, unidentifiable paper, and paperboard.
6. Vehicle: automobile parts from accidents, do-it-yourself car maintenance debris, and tire debris.
7. Construction/Industrial: construction and demolition debris (e.g., shingles, wood, electrical, drywall, Tyvek, foam insulation, industrial rags, and tarps, etc.). Industrial and business are also included due to the similarities.
8. Home Items: lamps, clothes, toiletries, drug-related items along with packing materials and other items likely to have originated from homes. This also includes home food items such as food jars, bottles and tea packets.
9. Bags: paper, plastic and reusable bags separated by those used for shopping, trash, and leaves. Those with brand names were separately tallied from generic bags such as “thank you” bags.
10. Tobacco-Related: lighters, packages, and matchbooks along with any cigarette or cigar butts that were two inches or larger.

3.0 ANALYSIS OF LARGE LITTER

A detailed analysis on the rate, extent and composition of all large litter found on the 253 sites was performed. The largest category of Large Litter in 2023 was Beverage Containers (29.4%) followed by Vehicle Debris (21.2%) as shown in Table 3-1. Together, these two categories comprise more than half of all Large Litter.

Table 3-1 - Large Litter by Category: Percentages

Category	2013	2019	2023
Beverage Containers	16.0%	13.2%	29.4%
Vehicle Debris	22.5%	35.4%	21.2%
Construction/Industrial	17.0%	14.4%	11.5%
Cup-Related	5.6%	6.6%	9.8%
Paper	19.6%	11.8%	7.3%
Home & Home Food	5.9%	6.6%	7.0%
Fast Food Packaging	6.6%	5.2%	6.2%
Bags	1.0%	1.3%	3.1%
Snack Wrappers	3.0%	3.2%	2.7%
Tobacco-Related	2.8%	2.5%	2.0%
Total	**100%**	**100%**	**100%**

When considering the tally counts themselves, slightly fewer Beverage Containers were observed in 2023 compared to 2019 even though that category was a larger overall percentage of litter in 2023. Vehicle Debris was reduced by 73.4% over the same period as shown in Table 3-2 below. In addition, every category saw a reduction in the amount of litter found, except for bags (plastic and paper).

Table 3-2 - Large Litter by Category: Tallies

Category	2013	2019	2023	Change (2023-2019)
Beverage Containers	4,746	3,266	3,233	-33
Vehicle Debris	6,678	8,744	2,328	-6,416
Construction/Industrial	5,060	3,559	1,259	-2,300
Cup-Related	1,661	1,618	1,081	-537
Paper	5,814	2,903	800	-2,103
Home & Home Food	1,762	1,619	677	-942
Fast Food Packaging	1,946	1,281	767	-514
Bags	294	309	342	33
Snack Wrappers	890	780	292	-488
Tobacco-Related	833	619	216	-403
Total	**29,684**	**24,698**	**10,995**	

3.1 Large Litter by Roadway Type

Between 2013 and 2023, Large Litter overall was reduced by 63.2%. In addition, between 2019 and 2023, Large Litter was reduced by 55.5%.

The reduction was consistent between all four roadway types. Interstates, which have the highest traffic levels and the highest littering rates of all four roadway types, showed the largest absolute reduction in litter.

Even though the amount of Large Litter on each roadway type varied substantially, the average number of Large Litter items found per mile at each of the four roadway types showed virtually identical levels of reduction by percentage that was consistent and noticeable between 2013 and 2023 as shown in Table 3-3.

Table 3-3 - Large Litter per Mile by Roadway: 2013-2023

Road Type	2013	2019	2023	Change	% Change
FM Roads	770	620	279	(491)	-63.8%
Interstates	1,773	1,481	653	(1,120)	-63.2%
State Roads	1,007	832	370	(637)	-63.3%
U.S. Highways	921	765	343	(578)	-62.8%

3.2 Large Litter by Material Composition

Table 3-4 compares the most littered items by composition in 2023. These comparisons are illustrated by percentage for each roadway type. Items made of plastic were the most prominent in terms of material composition across the board, comprising almost 40% of Large Litter on each roadway type.

Table 3-4 - Large Litter Composition by Roadway

% of Large Litter by Road Type – 2023				
Composition	**FM**	**IH**	**SR**	**US**
Plastic	39.9%	38.8%	39.8%	39.7%
Metal	25.7%	13.2%	20.8%	15.7%
Paper	11.2%	13.1%	15.5%	12.8%
Rubber	5.1%	22.3%	7.4%	13.4%
Glass	3.3%	1.0%	1.7%	2.7%
Wood	0.1%	0.1%	0.2%	0.1%
Textiles	2.3%	3.2%	3.3%	5.0%
Comp./Other	12.4%	8.3%	11.3%	10.6%

Metal items were also a notable percentage of litter for all roadway types. Rubber was much higher on Interstates than on any other roadway. The higher incidence of Rubber is likely due to the large number of eighteen-wheelers and the high speed of traffic on Interstates. Almost all rubber debris consists of tires or pieces of tires.

The physical composition of Large Litter for all roadways combined in 2023 is shown in the following, Figure 4. The largest categories were Plastic (39.2%) and Metal (16.8%). These were followed by Rubber (15.4%) and Paper (13.1%).

Figure 4 - Composition of Large Litter

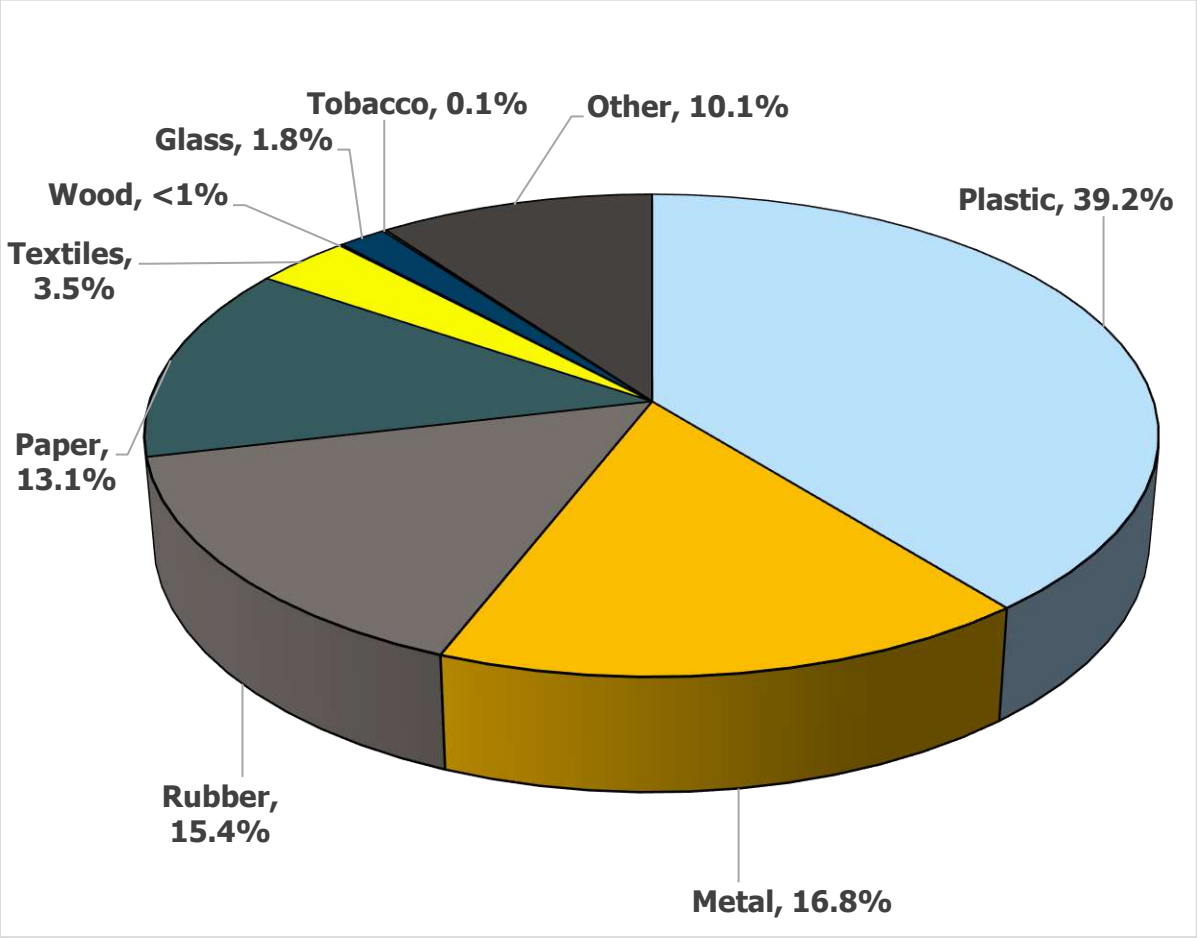


Table 3-5 shows how the composition of litter has changed since 2013. Items comprised of plastic grew significantly as a percentage of Large Litter between 2013 and 2023. This corresponds to nationwide trends of using plastics for packaging, containers and other material components. The percentage of metal items doubled over the same period. Rubber, Glass and Paper items were the only categories whose percentages have declined since 2013.

Table 3-5 - Large Litter Composition

Material Composition	2013	2019	2023
Plastic	22.0%	24.8%	39.2%
Metal	8.0%	15.1%	16.8%
Paper	20.0%	17.5%	13.1%
Rubber	20.0%	28.5%	15.4%
Glass	3.0%	1.3%	1.8%
Textiles	3.0%	1.7%	3.5%
Wood	<1%	<1%	<1%
Composite/Other	23.0%	10.0%	10.1%
Total	**100%**	**100%**	**100.0%**

3.3 Recyclables in Large Litter

Large Litter tends to include a significant percentage of recyclable items, particularly Beverage Containers and Paper that could easily have been recovered rather than discarded.

Table 3-6 shows the percentage of recyclables in Large Litter for each of the three survey years. As shown below, the number of recyclables was reduced substantially between 2013 and 2023 although these items increased as a percentage of all Large Litter over the same period.

Table 3-6 - Recyclables in Large Litter

Year	Large Litter	Recyclable	% of Large Litter
2013	29,684	10,560	35.6%
2019	24,698	6,169	25.0%
2023	10,995	4,139	37.6%

3.4 Large Litter Sources

Based on contextual conditions at each site including the types, amounts and location of littered items, the likely sources of litter were identified. Compiling the weighted percentages from each site yields a total survey-wide estimate. As shown in Figure 5, items deemed to have been discarded by motorists accounted for slightly less than half of all Large Litter.

Vehicle Debris, which includes items such as blown tires and car parts from accidents, accounted for 19.5% of all Large Litter and is generally considered unintentional litter. Litter from Construction haulers and other unsecured trucks accounted for nearly 21% of all Large Litter.

Figure 5 - Sources of Large Litter

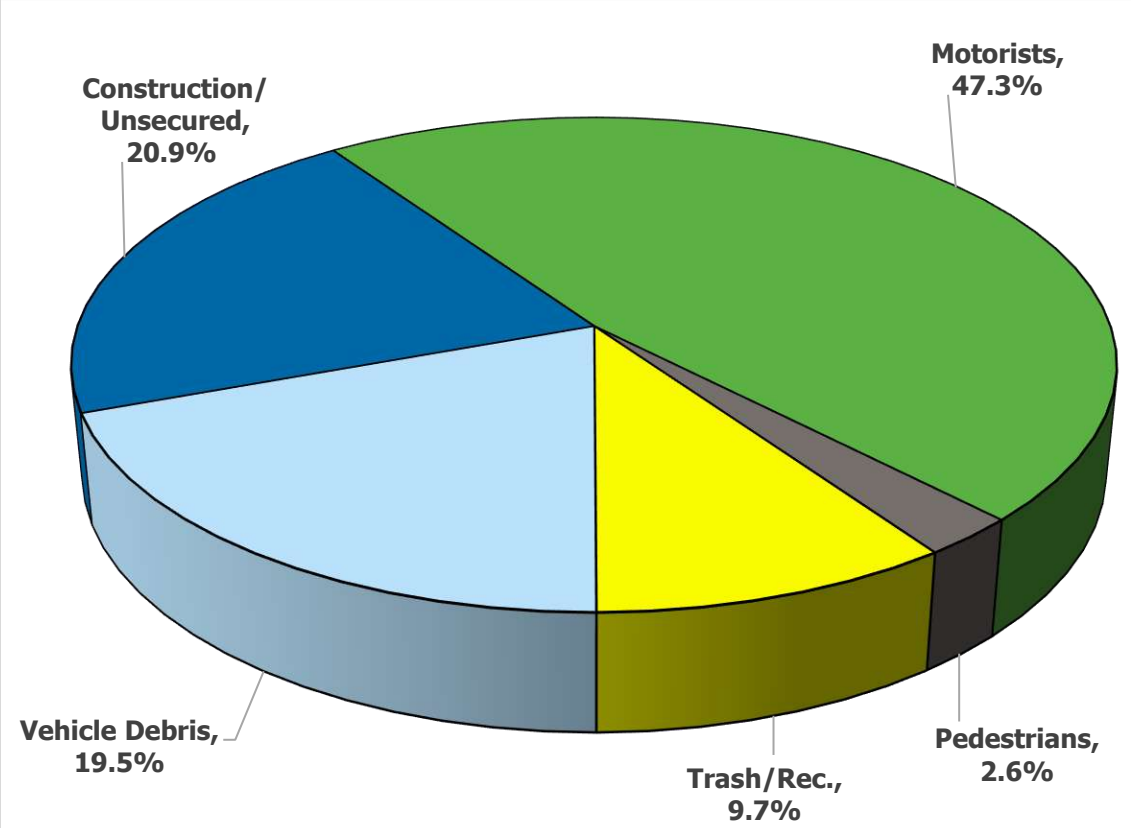
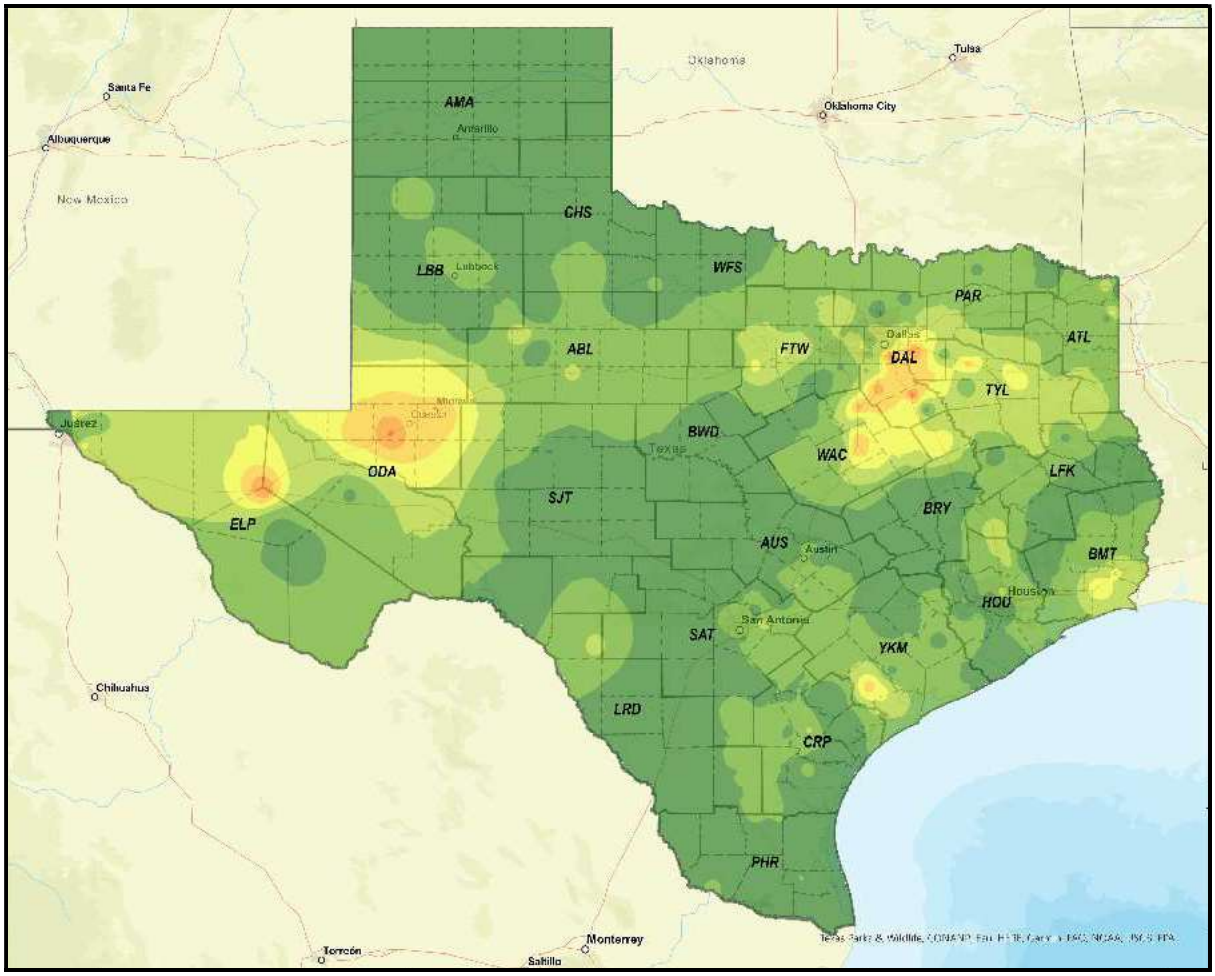


Figure 6 - Large Litter Heat Map



Heat Maps are graphical representations of data that utilize color-coded systems. For purposes of a Large Litter Survey, the primary purpose of a Heat Map is to better visualize the volume of litter, by location within a dataset and assist in directing viewers towards areas on data visualizations that matter most. Figure 6 shows a Large Litter intensity map that identifies areas by the amounts of littered items observed in sites within each TxDOT district. The ODA (Odessa) district is the most heavily littered while sites such as El Paso and the areas between Waco and Dallas. The Large Litter Heat Map is available to review in its entirety in Appendix D.

4.0 MICRO LITTER

All littered items smaller than two inches were tallied as components of Micro Litter and were analyzed separately from the larger Large Litter items. Findings from the Micro Litter analysis are provided below.

4.1 Findings

Table 4-1 shows the components of Micro Litter sorted by ranking. As was true in past surveys, Cigarette Butts (29.2%) were found to be the most pervasive type of Micro Litter by a large margin.

Rubber (13.6%), in the form of tire scraps, and Hard Plastic (13.4%) were also notable components as well. Together these three components comprised 56.2% of Micro Litter.

Table 4-1 - Components of Micro Litter

Micro Litter	2023	% of Total
Cigarette Butts	123,256	29.2%
Rubber	57,262	13.6%
Plastic – Hard	56,703	13.4%
Poly – Other	30,566	7.2%
Paper	27,756	6.6%
Bottle Caps	25,075	5.9%
Aluminum	24,304	5.8%
Glass	22,819	5.4%
Snack Wraps	13,921	3.3%
Plastic Film	7,045	1.7%
Straws	6,986	1.7%
Cigar Butts	6,750	1.6%
Food-Related	6,641	1.6%
Metal	5,107	1.2%
Other	4,227	1.0%
Tobacco Packaging	2,761	0.7%
Poly – Peanuts	706	0.2%
Gum Wrappers	118	0.0%
Total	**422,003**	**100.0%**

Although Micro Litter increased by 89.8% between 2013 and 2019, it decreased by 13.2% between 2019 and 2023. Table 4-2 shows that the decrease in Micro Litter since 2019 can be seen in 11 of the 18 categories. In terms of the actual tallies, cigarette butts, tobacco packaging, bottle caps, food-related items and hard plastic items have increased consistently between 2013 and 2023. Only gum wrappers and polystyrene peanuts decreased consistently between 2013 and 2023.

Table 4-2 - Changes in Micro Litter

Micro Litter	2013	2019	2023	2013-23 Change	2019-23 Change
Aluminum	7,157	5,872	24,304	17,147	18,432
Bottle Caps	6,805	10,571	25,075	18,270	14,504
Snack Wraps	8,272	23,765	13,921	5,649	-9,844
Gum Wrappers	4,576	998	118	-4,458	-880
Cigar Butts	4,224	17,079	6,750	2,526	-10,329
Cigarette Butts	72,277	117,573	123,256	50,979	5,683
Food-Related	117	1,585	6,641	6,524	5,056
Glass	11,381	34,969	22,819	11,438	-12,150
Metal	3,051	9,689	5,107	2,056	-4,582
Other	645	10,505	4,227	3,582	-6,278
Tobacco Packaging	1,232	2,056	2,761	1,529	705
Paper	38,133	61,195	27,756	-10,377	-33,439
Plastic Film	12,144	18,192	7,045	-5,099	-11,147
Plastic - Hard	22,469	49,929	56,703	34,234	6,774
Poly Peanuts	3,989	3,816	706	-3,283	-3,110
Poly - Other	18,187	32,273	30,566	12,379	-1,707
Rubber	38,309	85,248	57,262	18,953	-27,986
Straws	3,168	824	6,986	3,818	6,162
Total	**256,136**	**486,139**	**422,003**	**165,867**	**-64,136**

Comparing changes in Micro Litter by roadway type shows a significant increase between 2013 and 2019, particularly along Interstates (+105.2%) and U.S. Highways (+101.2%) as shown in Table 4-3. However, between 2019 and 2023, Micro Litter only increased along FM roads. The overall rise of Micro Litter in the face of declining Large Litter could occur when there are consistent litter cleanups from state, local and Adopt-a-Highway programs, which tend to focus on larger items of litter, but typically not the smaller ones.

Table 4-3- Micro Litter: Averages per Site by Roadway 2013 - 2023

Road Type	2013	2019	2023	2013-23	2019-23
FM Roads	667	975	1,340	+673	+365
Interstates	1,385	2,842	2,232	+847	-610
State Roads	1032	1,749	1,438	+406	-311
U.S. Highways	817	1,644	1,521	+704	-123

4.2 Micro Litter by Material Composition

Plastic (31.1%) comprised the largest component by composition of Micro Litter in 2023, which it had not in either 2013 or 2019, continuing the trend of increased plastics in both the solid waste and litter streams. This was followed by Tobacco (30.8%) as shown in Figure 7. Rubber (13.6%) was also a notable component. Of all Micro Litter components, only Paper components were deemed recyclable at the time they were discarded.

Figure 7 - Composition of Micro Litter

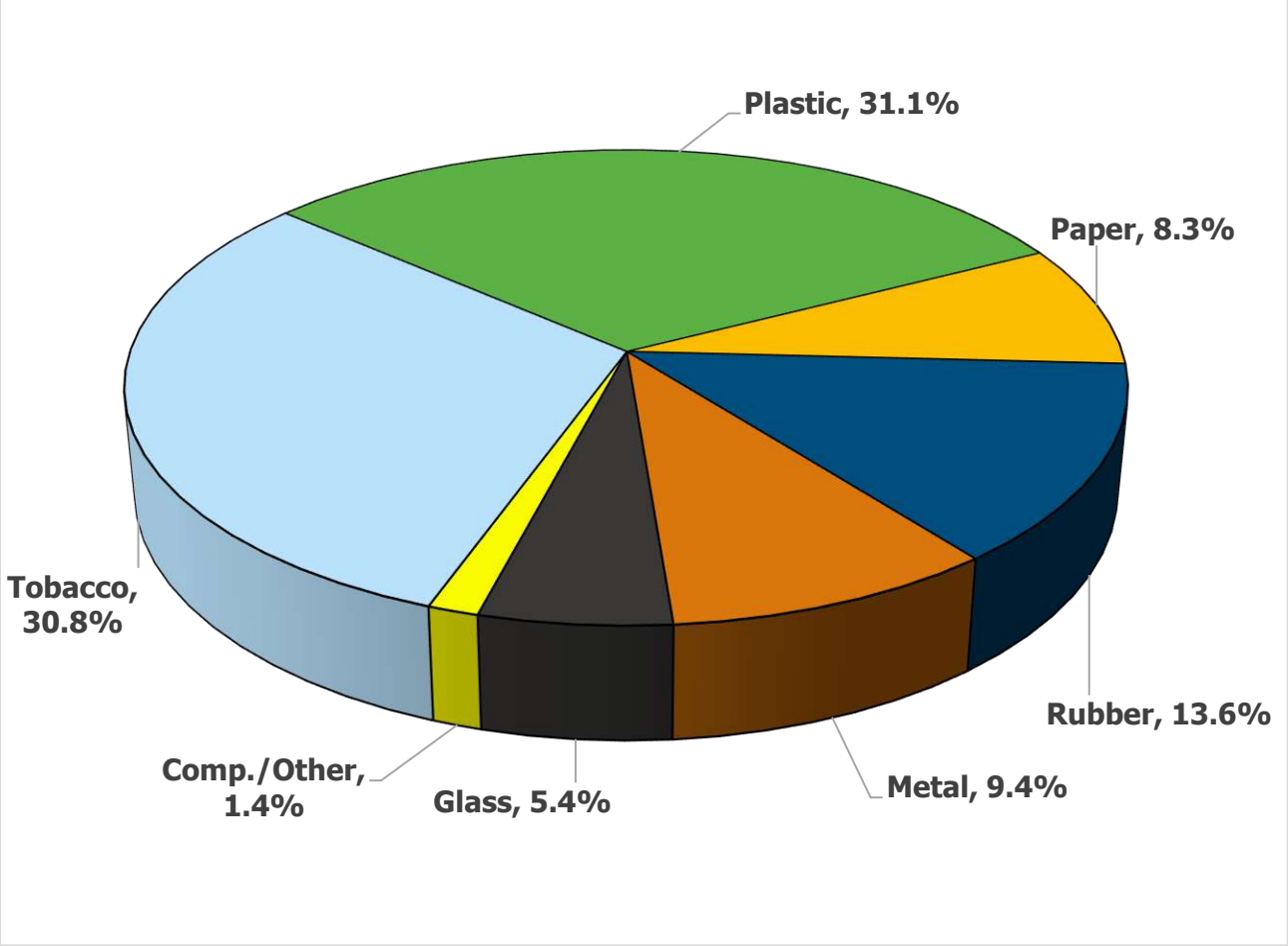


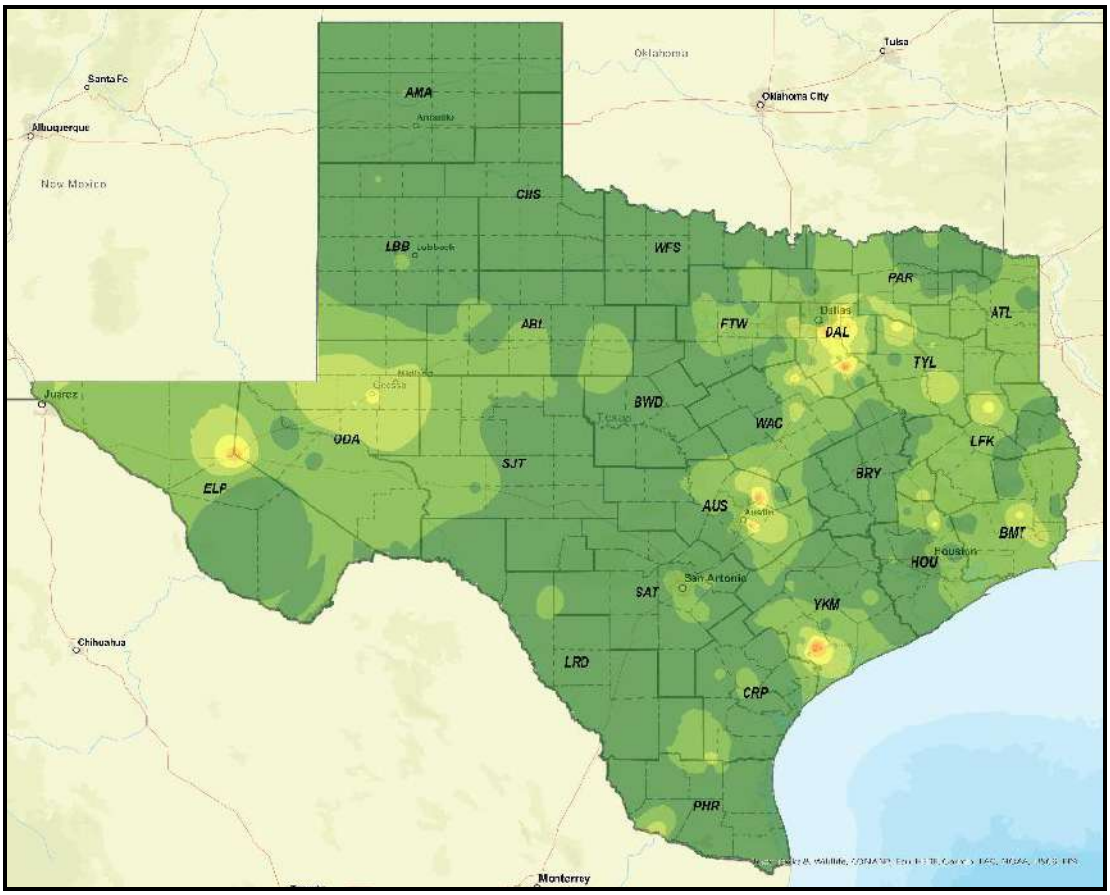
Table 4-4 shows the percentage of Micro Litter attributable for each material type. While Tobacco has remained within a fairly constant range between 2013 and 2023, Plastic has increased over that same time period which correlates to the increased use of plastic packaging in the waste stream.

Table 4-4 - Micro Litter: 2013-2023

Micro Litter	2013	2019	2023
Plastic	26.2%	24.1%	31.1%
Metal	8.8%	8.2%	9.4%
Paper	15.5%	12.8%	8.3%
Rubber	15.0%	17.5%	13.6%
Glass	4.4%	7.2%	5.4%
Tobacco	29.9%	27.7%	30.8%
Composite/Other	0.3%	2.5%	1.4%
Total	**100%**	**100%**	**100%**

Figure 8 shows a Micro Litter intensity map that identifies areas by the amounts of littered items observed in sites within each area. Note the similarities in areas that were more heavily littered statewide with Large Litter. The Micro Litter Heat Map is available in its entirety in Appendix D.

Figure 8 - Micro Litter Heat Map



5.0 STATISTICAL TESTS

5.1 Sampling

In statistical studies, a sample is normally taken, studied, and analyzed in order to draw inferences or make conclusions about an entire population. For the purposes of this study, it would be prohibitive to survey every roadside in the State of Texas. Therefore, a representative sample of 253 survey sites was chosen, data were obtained and recorded, and tabulations and analyses were conducted to reach conclusions about the state of Texas roadways overall as they relate to cleanliness.

5.2 Statistical Significance

When a statistical test is performed, one result is typically a value or number (statistic) which aids in interpretation and understanding of the outcome of that test. In particular, it is usually asked if the resulting value is “statistically significant.” One factor in determining the answer for a given value is the size of the sample. Another is the chosen “level of significance.” Often, a level of 0.05 is the favored choice.

Suppose, hypothetically, we are wondering if roads with a “double” center line are littered to a different extent than roads with a “single” center line. We survey a sample of each kind, tally the results, compare the averages and run a statistical test. If we get a number “significant” at the 0.05 level, then the conclusion is reached that double-line roads are, on the average, more heavily littered. The chosen significance level of 0.05 means that there is only a 5% risk (one chance in 20) that such a conclusion is incorrect and that no actual difference exists.

5.3 Correlation Analyses

A correlation analysis is a type of statistical test that yields a correlation coefficient, a number (statistic) used to measure the strength of a relationship between two variables.

The most common type of correlation is the Pearson Product Moment Correlation, which examines the linear relationship between two sets of data and is the correlation type used in this analysis.

A correlation coefficient can be positive or negative but is never less than -1 and never greater than +1. A positive correlation means that high scores on one variable are associated with high scores on the other variable, while low scores on one are associated with low scores on the other. On the other hand, a negative correlation means that high scores on one variable are associated with low scores on the other.

It should be noted that a correlation can only indicate the presence or absence of a relationship and not the exact nature of the relationship. A high correlation in itself does not mean that one variable necessarily causes the other.

A correlation of zero, or close to it (either positive or negative), suggests that there is little or no relationship between the variables. The closer you get to +1 or -1, the stronger the relationship. However, the significance of any result would also depend largely on the size of the sample (that is, the number of measurements). Given the large number (253) of roadway sites surveyed in this study, it would only require a correlation coefficient of approximately 0.123 to be statistically significant at the 0.05 level.

5.4 Proximity Indicators

At each survey site, it was determined whether a proximity indicator was, as the phrase suggests, nearby. Correlation analyses were conducted to determine whether the proximity of these indicators was associated with the amount of litter found at the sites surveyed. The results are shown in Table 5-1. Note that in this section, the category of Vehicle Debris includes Tire Debris. Also note that in addition to a category for total Large Litter, there is a separate category for Large Litter without (i.e., excluding) Vehicle Debris.

Table 5-1 - Correlations: Proximity Indicators and Litter Counts by Category

Proximity Indicator	Bev. Cont.	Misc. Paper	Vehicle Debris	Construction/ Bus./Ind. Debris	Large Litter	Large w/o Veh. Deb.	Micro Litter
Beautification	-0.168	-0.085	-0.101	-0.048	-0.114	-0.100	-0.066
Agric. Area	-0.076	-0.008	-0.065	0.037	0.068	-0.057	-0.143
Conv. Store	-0.095	0.046	-0.117	-0.056	-0.087	-0.057	0.056
Fast-Food Est.	-0.075	0.054	-0.049	-0.023	-0.025	-0.009	0.056
Construction	0.124	0.191	0.099	0.123	0.145	0.141	0.026
Church	-0.080	-0.064	-0.046	-0.068	-0.080	-0.083	-0.071
School	-0.129	-0.073	-0.055	-0.050	-0.104	-0.108	-0.071
Res. Area	0.130	-0.054	-0.142	-0.144	-0.144	-0.120	-0.048
Bus. Area	-0.176	0.006	-0.109	0.021	-0.107	-0.088	0.010

Note. The highlighted values are statistically significant at the .05 level.

Not all Large Litter categories are shown in Table 5-1. For the category of "Snack Wrappers," just over half (50.2%) of the sites had zero Snack Wrapper litter (i.e., none at all), and the data did not warrant analysis. A correlation analysis of Proximity Indicators in relation to Fast Food litter, combined with Cup-related litter, was conducted. However, the correlations were all quite small (none were significant), so those results did not warrant reporting or discussion. The same was true for the "Home Items" category.

To clarify, a positive correlation coefficient in Table 5-1 means that, on the average, more litter of the designated category is found at sites where more of the designated Proximity Indicators are found. A negative correlation means less overall litter where those Proximity Indicators occur.

Regarding the Proximity Indicators themselves, three of those presented in Table 5-1 – fast food establishments, churches, and schools -- were present at less than 5% of the sites, suggesting that the individual correlations might not be considered very meaningful. However, for churches and schools, the correlations do show a clear pattern; namely, all the correlations are negative. Thus, there was less litter present at sites in proximity to churches and schools, suggesting either that people are less likely to intentionally litter in these

establishments, or that churches and schools are more likely to clean up litter on their properties**.** Indeed, the correlation for schools versus beverage containers was statistically significant.

For sites in proximity to beautification efforts, the pattern is even stronger: all the correlations are again negative, with a strong and statistically significant result for Beverage Containers. Thus, sites in the vicinity of beautification efforts tend to be cleaner.

Regarding sites in (or not in) proximity to agricultural efforts, the correlations coefficients are very small for the Large Litter categories, most being negative with one small positive result. However, the correlation coefficient for Micro Litter is more prominent, with a negative and statistically significant coefficient of -0.143, indicating that less Micro Litter is found near agricultural sites.

For the Proximity Indicator “convenience stores,” none of the correlation coefficients were statistically significant, but the results are interesting, nonetheless. All the correlations for Large Litter are very modest but negative, yet for Micro Litter the correlation is very modest yet positive. One might speculate that some effort is being made to clean up larger pieces of litter, with perhaps less attention to smaller pieces. A similar pattern of correlations exists for Fast Food Establishments, and a similar speculation seems plausible.

Survey sites in proximity to construction show a strong, clear result, with all correlations positive and five of them statistically significant. Interestingly, the coefficient for Micro Litter is quite small, though still positive. It seems safe to state that sites at or near construction are more littered, especially with Large Litter.

Virtually the opposite is true for Residential sites. Here, four of the Large Litter categories have negative and statistically significant correlations, while the correlation for Micro Litter is modest but still negative. Thus, residential area sites are less littered, especially with regard to Large Litter.

For sites in proximity to businesses, the only notable outcome shown in Table 5-1 is the negative and statistically significant correlation for Beverage Containers, indicating less litter of that nature near businesses. Finally, regarding Beverage Containers themselves, Table 5-1 indicates that Beverage Container litter is negatively correlated with eight of the nine Proximity Indicators, with four statistically significant results. The only exception is for sites in proximity to Construction, for which the correlation is not only positive, but is statistically significant.

5.5 T-tests for Averages

A t-test is a type of statistical procedure used to examine the average values of two sets of data obtained through sampling. The t-test directly compares the difference between those averages or means, but also takes into account other factors. One factor is the standard deviation of each set of values, which is basically a measure of how widely dispersed the values are. The other factor is the number of values, or sample size, for each data set.

Based on these considerations, the t-test addresses the extent to which a true difference exists between the populations of values from which the data have been sampled and expresses the significance that can be attributed to such differences.

Average litter values were calculated across sites for each of three proximity indicators, selected based on the results of the correlation analyses, and three categories: Vehicle Debris, Large Litter, and Micro Litter. T-tests were performed on the data. The results are reported in Table 5-2.

Table 5-2 - Average Litter Values Associated with Proximity Indicators

Indicator	Y/N	Vehicle Debris	Large Litter	Micro Litter
Beautification	Yes	4.3	28.7	1,298.8
	No	9.7	44.9	1,704.9
Construction	Yes	13.8	61.8	1,811.9
	No	8.7	41.5	1,652.9
Residential	Yes	5.3	32.7	1,512.8
	No	10.4	46.7	1,714.2

Note. The highlighted averages are statistically different at the 0.05 level of significance.

For the litter categories shown, Table 5-2 indicates that the average litter values for survey sites in proximity to Beautification efforts are noticeably less than the values for other sites. For example, at the Yes (for proximity to Beautification) sites, the average Vehicle Debris litter value was 4.3, while at the No sites the average value was 9.7. Thus, the average for No sites was 123% greater than at Yes sites. For Large Litter

and Micro Litter, the average No sites were 57% and 31% greater, respectively. Although a strong pattern emerges, these differences were not statistically significant.

For sites in proximity to Construction, the opposite pattern may be seen in Table 5-2. There is, on average, 59% more Vehicle Debris litter at sites that are in proximity to Construction than at sites that are not: 13.8 versus 8.7. Although this difference is not statistically significant, the difference for Large Litter is significant at the 0.05 level, as may be seen by the color-coded averages in Table 5-2. Here, the Yes site average was 49% greater than the No site average. Note that the magnitude of percentages does not necessarily equate to statistical significance.

Finally, for sites in proximity to Residential areas, the averages for Vehicle Litter and Large Litter are significantly lower (at the 0.05 level) than for sites in proximity to non-residential areas, which are 97 and 43% higher, respectively.

5.6 Roadway Types

Some data regarding litter rates by roadway type were presented above. Those data suggest that there exist differences in littering tendencies among the four types of roadways. Table 5-3 presents the average litter counts obtained in the 2023 survey by roadway types for the ten litter categories.

Table 5-3 - Average Litter Counts by Roadway Type

Type of Litter	FM	IH	SR	US
Large Litter	27.93	65.25	36.98	34.31
Beverage Containers	10.85	16.48	12.92	9.61
Fast-Food/Cups	1.93	3.52	2.7	2.16
Snack Wrappers	1.13	1.22	1.25	1.01
Paper	1.24	4.89	3.39	2.24
Home Items	1.96	4.09	2.61	2.91
Vehicle Debris	2.17	19.58	3.95	6.57
Construction/Industrial	2.89	7.35	4.2	4.31
Non-Vehicle Debris	25.76	45.67	33.03	27.75
Micro Litter	1,217.13	2,232.03	1,438.44	1,521.49

For each litter category the lowest average litter count is highlighted in yellow, and the highest average is highlighted in orange. It will immediately be seen that for most litter categories, the lowest averages are for Farm-to-Market roads. Also, with one exception the highest averages are for State Roads.

Given that Farm-to-Market Roads had, in most categories, less average litter than each of the other three roadway types, the question remained as to whether these differences were statistically significant. Comparing FM roads with all others combined would be distorted by the high values for Interstates. Therefore, t-tests were conducted to compare the litter rates for FM Roads with State and US roadways combined. The differences were statistically significant (at the 0.05 level) only for the categories of Paper and Vehicle Debris, allowing the conclusion that FM Roads statewide have substantially less Vehicle Debris (and paper litter) than found on other roadways overall.

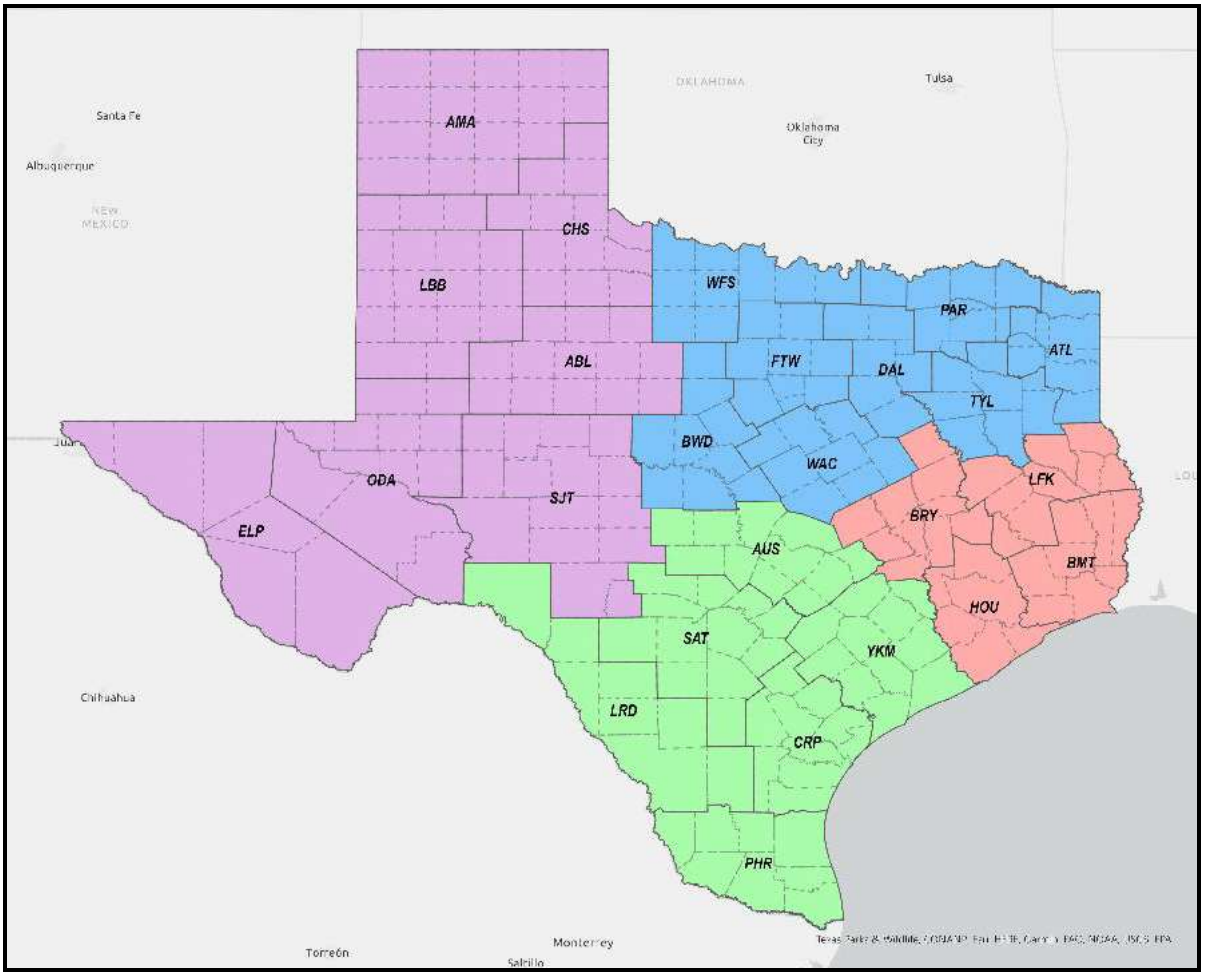
However, for Interstate Roads the situation is somewhat reversed and more pronounced. T-tests were conducted to compare the litter rates for Interstates with State and US roadways combined, which mirrors the procedure for FM roadways. The differences proved to be statistically significant (at the 0.05 level) for every category except snack wraps, the sole category where the IH average was not the greatest. This result allows, with a high level of confidence, the conclusion that Interstate Roads are more heavily littered than all other roadway types.

6.0 LITTER BY DISTRICTS AND REGIONS

6.1 Litter Rates by TxDOT District

Understanding which districts are the most heavily littered is important to better target resources on clean up and prevention efforts. For construction and maintenance purposes, TxDOT divides Texas into four regions and 25 districts. Each region consists of 4-8 districts. Each district consists of between 6-17 counties. Figure 9 below shows the breakdown of TxDOT districts and regions used to analyze littering rates. Please refer to Appendix D to review the TxDOT Districts and Regions Map in its entirety.

Figure 9 - TxDOT Districts and Regions



Since Tire Debris comprised such a large portion of both Large Litter (15.3%) and Micro Litter (13.5%) overall, it was deemed more impactful to show average litter rates per TxDOT district in three ways: (1) total litter, (2) tire debris only and (3) total litter except for tire debris. All tire debris is categorized as rubber, but not all rubber items are tire-related debris.

Table 6-1 below shows the average tally of litter by site in each of the TxDOT districts. The most littered of each is highlighted in yellow, the second most littered in gray and the third most littered in orange.

Table 6-1 - Average Litter Counts by TxDOT District

TxDOT		Total Litter			Tire Debris			Total Litter w/o Tire Debris		
District	Sites	Large	Micro	All	Large	Micro	All	Large	Micro	All
ABL	8	40	1,438	1,478	10	418	428	30	1,020	1,050
AMA	8	17	572	590	4	176	180	13	396	410
ATL	7	43	1,827	1,870	4	260	264	39	1,567	1,606
AUS	14	27	2,259	2,286	3	55	57	24	2,204	2,229
BMT	9	45	2,067	2,113	4	85	89	41	1,982	2,024
BRY	9	20	320	340	5	72	76	15	248	264
BWD	4	15	514	529	2	44	46	13	470	483
CHS	3	30	626	656	9	98	106	21	528	550
CRP	10	21	1,003	1,025	3	135	138	18	868	887
DAL	24	79	2,917	2,996	13	398	411	66	2,519	2,585
ELP	9	57	2,243	2,300	12	756	768	45	1,487	1,532
FTW	17	63	1,988	2,051	11	297	308	52	1,691	1,743
HOU	32	36	1,483	1,519	5	194	199	31	1,289	1,320
LDO	7	26	679	705	6	59	64	20	620	641
LUB	8	23	756	779	1	88	89	22	668	690
LUF	7	23	1,795	1,818	1	59	60	22	1,736	1,758
ODA	8	105	2,978	3,083	27	895	922	78	2,083	2,161
PHR	11	21	1,083	1,104	2	48	50	19	1,035	1,054
PRS	7	33	1,148	1,181	5	210	215	28	938	966
SAT	16	26	1,115	1,141	2	139	141	24	976	1,000
SJT	4	21	1,511	1,532	5	367	371	16	1,144	1,161
TYL	10	79	2,928	3,007	7	235	241	72	2,693	2,766
WAC	10	73	1,720	1,793	12	164	176	61	1,556	1,617
WFS	4	17	308	325	5	59	64	12	249	261
YKM	7	52	2,264	2,316	5	50	55	47	2,214	2,261
ALL	**253**	**43**	**1,668**	**1,711**	**7**	**226**	**233**	**37**	**1,442**	**1,479**

Because Micro Litter was such a dominant portion of litter, in every case the three districts with the highest amount of Micro Litter also had the highest amount of Total Litter as well. The high values in the ODA district are of particular interest since its DVM and district population are both close to the median for the state. The final line in Table 6-1 represents the average litter tally for all 253 sites in the state of Texas.

6.2 Litter Rates by Region

The 25 TxDOT districts are rolled up into four regional areas as shown in Table 6-2. The regional breakdown was conducted to allow each of the four field crews to focus their surveying on one geographical area of the state. This also provided the opportunity to compare resulting data among the four different areas of the state.

The West Region is more sparsely populated and much less traveled than the other three regions. Despite these demographics, littering was much higher than expected in this region due in part to the high littering rate observed in the ODA District.

Table 6-2 - Regional Demographics

Region	Daily Vehicle Miles	Population	Area (miles^2)	# of Sites
East	138,420,762	8,577,642	27,510	57
North	202,540,804	10,732,738	56,237	83
South	182,131,670	9,127,317	103,979	65
West	49,813,251	1,591,875	74,236	48
Total	**557,201,649**	**28,702,243**	**261,233**	**253**

Table 6-3 shows the average litter rates per site by region. The North Region, which includes the Dallas and Fort Worth metropolitan areas, yielded the highest average rate of Large Litter (62). This was followed distantly by the West Region.

Table 6-3 - Average Litter Counts by Region

TxDOT Region	Total Litter			Tire Debris			Litter w/o Tire Debris		
	Large	Micro	All	Large	Micro	All	Large	Micro	All
East	33	1,430	1,464	4	141	145	29	1,289	1,319
North	62	2,101	2,163	9	269	278	53	1,832	1,885
South	31	1,516	1,547	4	168	172	27	1,348	1,375
West	42	1,382	1,424	10	369	378	32	1,013	1,046
Texas	**43**	**1,668**	**1,711**	**7**	**226**	**233**	**37**	**1,442**	**1,479**

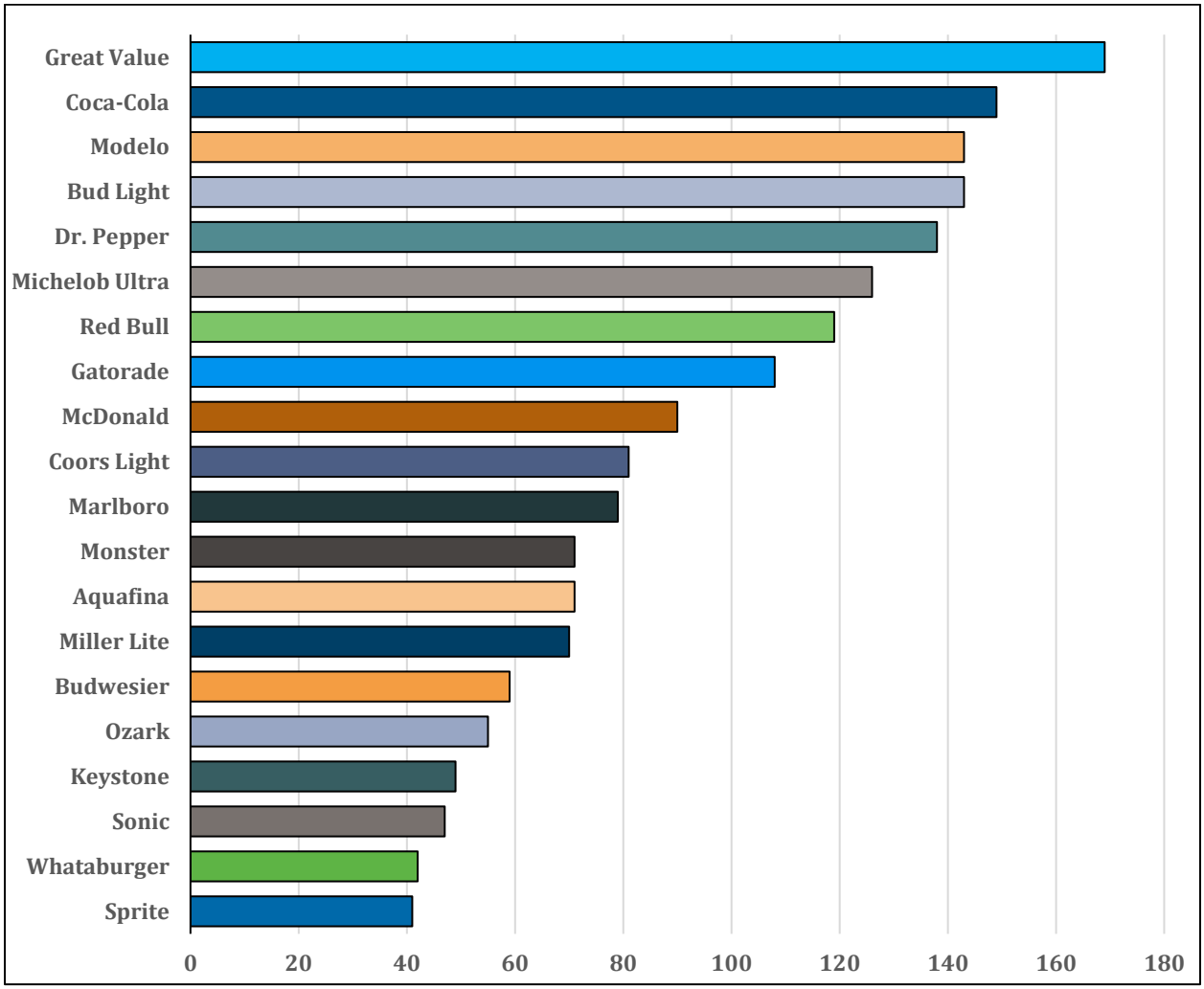
There was also a moderate correlation between Micro Litter and traffic and population levels when tire debris was excluded. Those values are highlighted in orange. None of the other values are considered statistically significant. It is of interest that all of the correlation values in Table 6-3 are slightly higher for population compared to daily vehicle miles. The values for Total Litter without Tire Debris are displayed with three decimal points to show that this was true even when the values were close.

Even if tire debris was not included, the North Region would still have the highest average rate of Large Litter (53) and Micro Litter (1,832). The West Region had the highest average rate of Tire Debris in Large Litter (10) and Micro Litter (369).

7.0 BRANDED LITTER

Prior Large Litter studies performed in Texas have recorded both the brand name as well as the quantity of items within that brand name to provide a better understanding of which brands contribute most to litter. As was done in 2013 and 2019, field crews noted the brand name of each item of litter collected where recognizable for both small and large items as shown in Figure 10.

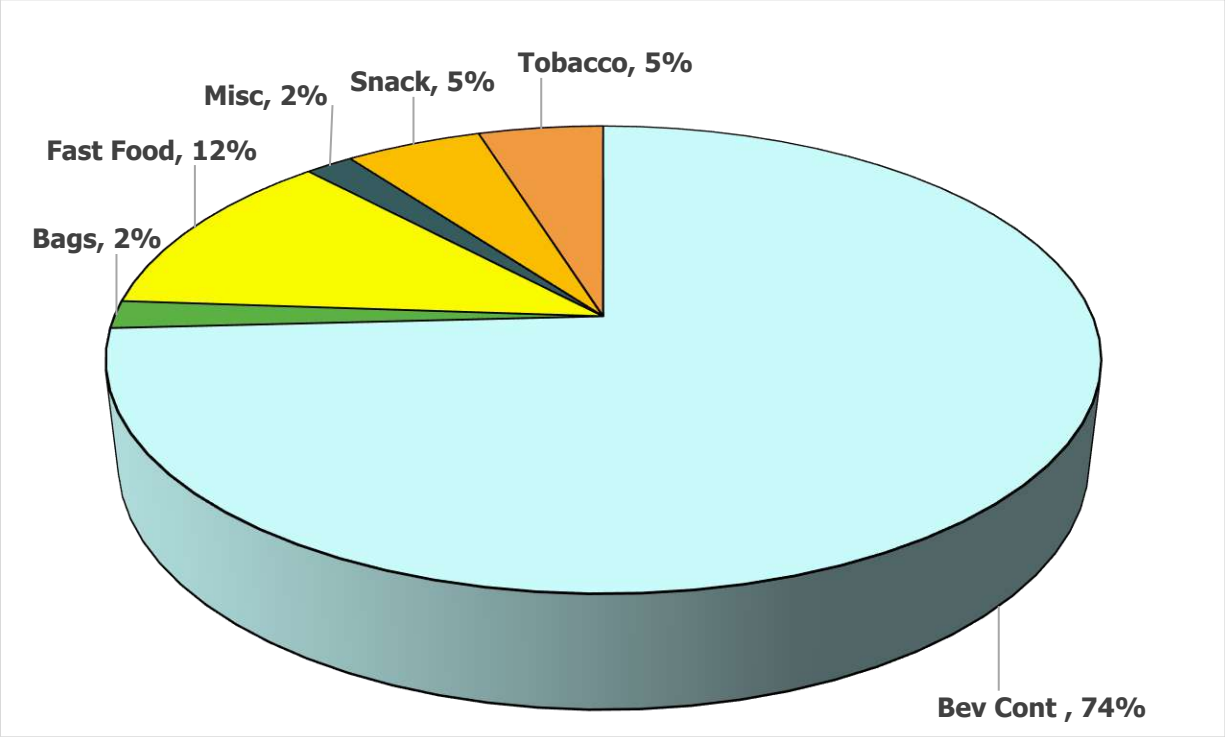
Figure 10 - Top 20 Most Common Litter Brand Names



In the 2023 survey, 3,342 items of branded litter were tallied. This included 428 unique brands compared to 475 in 2019. The most pervasive brand name observed in litter, as shown in Figure 10, was Great Value, a Walmart brand, which accounted for 5.1% of all brand names identified.

This was followed by Coca-Cola (4.5%), then by Modelo and Bud Light (both 4.3%). In total, the top 20 most common brand names comprised 55.4% of all brand name items counted. As shown in Figure 11, Beverage Containers comprised 74.2% of all branded items.

Figure 11 - Breakdown of Branded Litter by Type



The breakdown of labeled beverage containers identified by type is shown in Table 7-1 below. Beer comprised more than one-third of all branded beverage containers, while tea products were the smallest component of branded beverage container litter.

Table 7-1 – Branded Beverage Containers

Bev. Containers	Tally	Percent of Total
Beer	875	35.3%
Water	556	22.4%
Soft Drink	464	18.7%
Sports/Energy	380	15.3%
Alcohol	117	4.7%
Juice	47	1.9%
Tea	40	1.6%
Total	**2,479**	**100%**

8.0 CONCLUSIONS

Certain conclusions can be gathered from a high-level analysis of the data collected during the 2023 VLS. Key conclusions, in no particular order of impact, are presented below.

General

- While the littering rates for both Large Litter and Micro Litter varied by roadway types, Interstate highways were the most heavily traveled and the most heavily littered.
- In 2023, the field team surveyed several roadways that may have less litter than previous years due to new road designs and beautification efforts. This was particularly true in the Dallas-Fort Worth, Houston, and San Antonio areas. Both the visual observations and subsequent correlation analysis showed less litter in these new design areas.
- Items discarded from motorists accounted for 47% of all litter along TxDOT-maintained roadways.
- Vehicle Debris, which accounts for 20% of roadway litter, is best considered unintentional litter that litter abatement messaging is unlikely to affect.
- Tire Debris is the one component that could be best considered as unintentional litter that litter abatement messaging is unlikely to affect. Instead, the state should focus public education messaging directed towards the proper tire inflation and maintenance – especially as it relates to big rigs and other large commercial vehicles.
- Recyclables, (primarily Beverage Containers and Paper) comprised 36% of Large Litter in 2013, 25% of Large Litter in 2019, and 38% of Large Litter in 2023.
- Statistical tests show that sites near beautified areas tend to have lower levels of litter.
- Given the decrease in Large Litter, despite increases in both population and annual vehicle miles traveled, the Don't mess with Texas program is likely more effective than is realized.

Large Litter

- Large Litter along TxDOT-maintained roadways decreased overall by 55% between 2019 and 2023. This is a major accomplishment given the increase in age-eligible drivers and the number of roadway miles driven in the state.
- Beautification, including a significant 2023 wildflower season, may have also impacted large litter levels. The dense wildflower foliage either deterred littering or limited litter from moving beyond the road edge, resulting in large litter remaining outside the survey area, similar to the impact of cement barriers.
- The largest Large Litter classifications by composition were Plastic (39.2%) and Metal (16.8%).
- In 2023, Beverage Containers were the largest category of Large Litter (29%). Plastic Water bottles (8%) were the most littered type of beverage container.
- The ODA (Odessa) district is the most heavily littered area for Large Litter followed by El Paso and the areas between Waco and Dallas.

Small Litter

- Although Micro Litter increased by 90% between 2013 and 2019, it decreased by 13% between 2019 and 2023.
- Cigarette Butts continued to comprise the largest portion of Micro Litter in 2023 (29%), as was also the case in 2019 (24%) and 2013 (28%).
- Rubber (13.6%), in the form of tire scraps, and Hard Plastic (13.4%) were also notable components as well. Together these three components comprised 56.2% of Micro Litter.
- In terms of actual tallies, cigarette butts, tobacco packaging, bottle caps, food-related and hard plastic items have increased consistently between 2013 and 2023.
- The reduction in Micro Litter (which tends to compound itself when not cleaned) suggests that crews may be doing a better job cleaning existing litter prior to mowing grassy areas along TxDOT roadways then they were in 2019.

9.0 RECOMMENDATIONS

The Tetra Tech Project Team has provided a number of recommendations for TxDOT and DMWTX to consider. These recommendations are designed to help the state continue to reduce the incidence of litter across all roadway types and demographics.

- TxDOT should consider focusing litter prevention efforts on the most heavily littered areas identified by this survey.
- Work with the appropriate organizations to focus efforts to address proper tire inflation and maintenance, particularly on large commercial vehicles, can help reduce Vehicle Debris.
- Require removal of Large Litter before all mowing activities will help reduce Micro Litter.
- Develop more effective programs to reduce the amount of Cigarette Butt litter.
- Promote Beautification, including wildflower planting, since sites that were not in proximity to beautified areas had 57% more Large Litter on average than beautified sites.
- Supporting more effective Beverage Container and Paper recycling can help reduce the amount of litter from these categories.
- Continuing to promote the *Don't mess with Texas*® program will help ensure efforts to reduce roadside litter going forward. Survey results show that this program continues to have a positive impact on litter reduction.

APPENDICES

Appendix A – Methodology

Appendix B – Large Litter Components

Appendix C – Site Locations

Appendix D – Maps

Appendix E – Project Team Background

APPENDIX A – METHODOLOGY

The methodology used for the 2023 Texas Visible Litter Survey is based on the methodology that was used in the 2013 and 2019 litter surveys.

Conducting the Litter Survey

Each survey team was comprised of two people. Upon arriving at a site, the team safely parked their vehicle. Large worker signs were posted and traffic cones or flags were used to define site parameters. Team members were required to wear fluorescent orange/yellow traffic vests to increase visibility. The optimal site size was one-tenth mile (528 feet) x 18 feet. Conditions limiting access to a site's optimal width (e.g., walls or fences) were so noted.

Flags were used to mark the beginning, midpoint and end of each site. This helped identify sites that should not be cleaned and helped the survey teams return to the same survey points for the second survey.

The width of each site was measured from 1.5 feet inside the curb or the start of the pavement, towards the outer edge of the site, up to a maximum width of 18 feet and marked to indicate the boundary. This rule was set to include 1.5 feet into the street since curbs are normal catchment structures, for which DOTs typically ensure litter cleanup.

Litter Classification

For the 2023 Texas Litter Survey, litter was classified as Large Litter (>= two inches) and Micro Litter (< two inches). This breakdown helps define and clarify the extent to which litter item size is a factor in the evaluation of resultant data.

The litter tallies were recorded into 185 categories of Large Litter and 66 categories of Micro Litter. The more detailed list of components was then rolled up to match the categories used in 2013 and 2019 while still allowing a more detailed look at the makeup of roadside litter. A detailed description of each litter category is included in the Appendix.

Micro Litter was examined in three segments of each site: at the beginning, middle and end of each site. Each of these three segments comprised a 3' x 18' area. For each site, the resulting data from these three transects were then extrapolated to the total site area.

Additional Metrics Recorded

At each site, the ambient site information was recorded on the appropriate form, describing the site number, size and proximity to conditions (e.g., traffic signal, fast food or convenience stores, etc.) and providing a subjective visual rating. This data was subsequently used to determine proximity indicators.

APPENDIX B – LARGE LITTER COMPONENTS

All components of Large Litter are shown in Table B-1. This represents the data for all 253 sites.

Table B-1 - Large Litter Components

Large Litter Items	Percent of Total
Tire Debris	15.3%
Water (Plastic)	8.6%
Beer Cans	7.5%
Construction/Demolition Debris	3.9%
Vehicle Debris - Plastic	3.8%
Soft Drink (Cans)	3.3%
Paper Packaging - Other	2.9%
Polystyrene Cups (Foam)	2.6%
Energy (Cans)	2.2%
Corrugated Boxes	2.1%
Plastic Cup Lids	2.0%
Straws (Plastic)	1.8%
Tobacco Pkg including smokeless	1.7%
Clothing or Clothing Pieces	1.6%
Polystyrene Ice Chest Pieces	1.6%
Soft Drink (Plastic)	1.5%
Vehicle Debris - Metal	1.5%
Paper/Foil Wrap (Burger Wrappers)	1.4%
Plastic Drink Cups	1.3%
Napkins - No Brand	1.3%
Sweet Snack Wraps (Candy, Cake)	1.3%
Plastic Packaging - Not Film	1.2%
Snack Food Packaging (Doritos)	1.2%
Misc. Hard Plastic Pieces	1.2%
Rags	1.1%
Paper Cups	1.0%
Sport Drink (Plastic)	0.9%
Beer Bottles (Glass)	0.9%
Energy (Plastic)	0.9%
Plastic Retail Bags - No Brand	0.9%
Stationary (School, Business)	0.8%
Plastic Shrink Wrap	0.8%
Paper Food Wrap	0.8%
Receipts (Business, Transfers)	0.7%
Hygiene Products	0.7%

Large Litter Items	Percent of Total
Plastic Retail Bags - Brand	0.7%
Wine/ Liquor (Metal)	0.7%
Plastic Label	0.6%
Strapping - cloth	0.6%
Milk/Juice (Plastic)	0.5%
Broken Glass Container	0.5%
Polystyrene Foam Packing	0.5%
Paper Clamshells	0.5%
Polystyrene Clamshells	0.5%
Plastic Bags - Not Retail (Leaf, Trash)	0.5%
Straws/Wrappers (Paper)	0.5%
Paper Bags - Fast Food	0.5%
Wine/ Liquor (Plastic)	0.4%
Plastic Shells/Boxes	0.3%
Plastic Jars / Bottles (Non-Beverage)	0.3%
Paper Beverage Cases	0.3%
Paper Retail Bags - No Brand	0.3%
Plastic Flag	0.3%
Utensils (Plastic)	0.3%
Paper Cup Pieces	0.3%
Cans - Steel (Food/Non-Food)	0.2%
Auto Maintenance Debris	0.2%
Polystyrene Foam Insulation	0.2%
Container Lids (All Containers)	0.2%
Composite Materials - Other	0.2%
Tea (plastic)	0.2%
Foil Containers (Ice Cream)	0.2%
Paperboard (Cereal, Shoe Boxes)	0.2%
PPE Gloves	0.2%
Straws Wrappers Plastic	0.2%
Medical	0.2%
Zipper/Sandwich Bags	0.2%
Food Items (Apple Core, Banana Peel)	0.2%
Foil Pouches	0.2%
Tea (Metal)	0.2%
Cushion/Fiber Stuffing	0.2%
Strapping - rubber and metal	0.2%
Plastic Film Beverage Wrap	0.1%
PVC Pipe	0.1%

Large Litter Items	Percent of Total
Strapping - Plastic	0.1%
Cup Lids/Pieces	0.1%
Paper Fast Food Plates	0.1%
Water (Glass)	0.1%
Paper Trays	0.1%
Traffic Cement Stops	0.1%
Cigarette Butts	0.1%
Plastic Bucket/Lid	0.1%
Plastic Wrap	0.1%
Paper Label	0.1%
Plastic Landscape Tub	0.1%
Wire Grill	0.1%
Paper Retail Bags - Brand	0.1%
Plastic Bags - Fast Food	0.1%
Coffee (Cans)	0.1%
Soft Drink (Glass)	0.1%
Plastic Fast-Food Plates	0.1%
Netting (Hay)	0.1%
Rope	0.1%
Cigarette Lighter	0.1%
Sport Drink (Cans)	0.1%
Cans - Aluminum (Non-Beverage)	0.1%
License Plates	0.1%
Aerosol Cans (Paint, Oils, Etc.)	0.1%
Plastic Tape	0.1%
Basket	0.1%
PPE Mask	0.1%
Napkins - Brand	0.1%
Other Plastic Food Packaging	0.1%
Home Articles (Lamps, Chairs)	0.1%
Paper Bags - Not Retail (Leaf, etc.)	0.1%
Six Pack Plastic Rings	0.1%
Water (Can)	0.1%
Polystyrene Fast-Food Plates	0.1%
Polystyrene Trays	0.1%
Foil Materials/Pieces (Industrial)	0.1%
Wine/ Liquor (Glass)	0.1%
Lottery Tickets	0.1%
Traffic cone	0.1%

Large Litter Items	Percent of Total
Plastic Air-filled Packing	0.1%
Milk/Juice (Metal)	<0.1%
Tubing/hose	<0.1%
Kooz Cover	<0.1%
Tires (Whole)	<0.1%
Metal Reusable Cup	<0.1%
Rug/Carpet	<0.1%
Dryer Sheets	<0.1%
Plastic Toy	<0.1%
Milk/Juice (Gable Top)	<0.1%
Milk/Juice (Glass)	<0.1%
Newspapers/Magazines	<0.1%
Truck floor mats	<0.1%
Truck tire flap	<0.1%
Metal Sign	<0.1%
Sign Plastic	<0.1%
String - Plastic Hay	<0.1%
Cell Phone	<0.1%
Glasses Lens/Sunglasses	<0.1%
Labels	<0.1%
E-Cigarette	<0.1%
Coffee (Glass)	<0.1%
Tea (Glass)	<0.1%
Utensils (Metal, Chopsticks)	<0.1%
Air Fresher Car	<0.1%
Tire	<0.1%
Duct Tape	<0.1%
Metal Tool - Wrench/Vice Grip	<0.1%
Sandbag	<0.1%
Balloon	<0.1%
Bow	<0.1%
Ice Chest	<0.1%
Ice Chest Lid - Hard Plastic	<0.1%
Mailbox/Door Plastic	<0.1%
Skateboard	<0.1%
Trash Can and Lid	<0.1%
Aseptic (Box)	<0.1%
Ice cream stick	<0.1%
Glass Jars/ Bottles (Non-Beverage)	<0.1%

Large Litter Items	Percent of Total
Car window cooling shade	<0.1%
Mesh Feed Bag	<0.1%
Metal lock	<0.1%
Metal paint lid	<0.1%
Metal Paint-lid	<0.1%
Metal sign Stand	<0.1%
Nail	<0.1%
Orange fencing	<0.1%
Paint Brush	<0.1%
Safety Vest	<0.1%
Sponge	<0.1%
Velcro - Bus	<0.1%
Velcro -C&D	<0.1%
White Plastic Bucket	<0.1%
Chip board/electronic	<0.1%
Clay Pot	<0.1%
Dog poop	<0.1%
Hanger	<0.1%
Hotel Card	<0.1%
Marker	<0.1%
Mattress	<0.1%
Pencil	<0.1%
Phone Case	<0.1%
Plastic Flashlight	<0.1%
Plastic storage box	<0.1%
Ribbon Cloth	<0.1%
Shotgun Shell	<0.1%
Sticker	<0.1%
Swim Noodle	<0.1%
Cigar Butt	<0.1%
Coffee (Plastic)	<0.1%
Insulation - Fiberglass	<0.1%
Wire	<0.1%

APPENDIX C – SITE LOCATIONS

Table C-1 provides a description of the site locations used for the 2023 Texas Litter Survey. The locations for each site were based on the points used in the 2013 and 2019 surveys. When a site was unavailable due to factors such as construction, the next available area that was safe to survey was selected as a replacement. GPS coordinates for each site were taken.

Table C-1 - Site Locations

District	County	Site Location
ABL01	CALLAHAN	IH-20: about 250 feet southeast of intersection with FM-603 and near exit 297
ABL02	SCURRY	US-84: about 420 feet south of intersection with FM-612 near Snyder and Fluvanna
ABL03	CALLAHAN	SH-36: about 440 feet west of intersection with US-283 about 11.5 miles south of I-20
ABL04	NOLAN	IH-20/US-84 E: near exit 241 about 2400 feet northwest of Freedom RV Park
ABL05	TAYLOR	IH-20/US-84: near exit 277 about 1700 feet east of FM-707
ABL06	KENT	US-380: 0.1 miles past int. with FM-1081
ABL07	SCURRY	SH-350/SH-208/College Ave south of intersection with US-180/25th Street in Snyder
ABL08	HASKELL	FM-617: about 1000 feet west of intersection with US-277 in Weinert
AMA02	CARSON	IH-40/US-66: near mile marker 105 and about 2250 feet west of intersection with FM-2880
AMA03	POTTER	US-87/US-287: about 800 south of intersection with TX-354 and FM-1913 north of Town of Masterson
AMA04	MOORE	SH-152: about 100 feet west of intersection with FM-1284 and Road 17
AMA05	OLDHAM	IH-40/US-66: near exit 49 and Town of Wildorado
AMA06	CARSON	IH-40: near exit 98 and east of SH-207 in Town of Groom
AMA07	RANDALL	IH-27/Marshall Formby Memorial Highway: Road Test 485336 sign near mile marker 106
AMA08	HARTLEY	US-385: about 3.5 miles north of intersection with US-354/FM-767 in Town of Channing
AMA09	OLDHAM	SH-214/FM-290: about 760 feet south of intersection with I-40/US-66 exit 22
ATL01	BOWIE	US-59/US-71: 1 mile north of Loop 14/Texas Blvd/Arkansas Blvd, traveling north
ATL03	BOWIE	SH-93: 0.1-mile northeast of intersection with FM-558/Old Buchanan Road, north of Wagner Creek, traveling northeast

District	County	Site Location
ATL05	BOWIE	IH-30 East past intersection overpass for FM 3419 (Old Redlick Road)
ATL06	CASS	FM-251/S William Street: 0.1 mile south of intersection with SH-77, south of Atlanta, traveling south
ATL07	TITUS	IH-30: 0.1 mile west of Exit 162, near US-271, traveling west
ATL08	BOWIE	FM-44: 0.1 mile west of intersection with US-259, south of De Kalb, west of New Boston, traveling west
ATL09	BOWIE	FM-74 (Houston Street): 0.1 mile east of intersection with Co Rd 3775 about 1-mile past SH-236 in Queens City, traveling east
AUS00	TRAVIS	SH-16: near Triple Creek Road, past City of Fredericksburg
AUS01	GILLESPIE	FM-2244/Bee Caves Road, approximately 0.1 miles from Bee Cave Parkway
AUS04	TRAVIS	US-183: near FM-812
AUS05	TRAVIS	FM-969: near FM-973 west of Sh-45/SH-130 near Thunderbird Farms
AUS08	HAYS	IH-35: near Exit 223A
AUS10	TRAVIS	SH-71: near FM-973
AUS11	HAYS	US-79: near FM-685
AUS12	MASON	SH-29: near FM-1222
AUS15	WILLIAMSON	US-79: near HEB Plus (1740 E Palm Valley Blvd.)
AUS17	CALDWELL	FM-2720: near SH-142
AUS18	BLANCO	FM-2766: near US-281
AUS19	HAYS	IH-35: 0.5 miles directly past FM-150, past Town of Kyle, TX
AUS20	WILLIAMSON	US-79: near FM-1063
AUS21	HAYS	SH-21: 0.5 miles past SH-21 and FM-150 intersection near City of Uhland, past San Marcos Municipal Airport
BMT01	ORANGE	IH-10: 0.1-mile past Neches River Bridge
BMT02	LIBERTY	US-59: 0.1 mile past the intersection with SH-105 near the MONTGOMERY COUNTY Line
BMT03	LIBERTY	SH-321: 0.1-mile past intersection with FM-1008
BMT04	LIBERTY	FM-1960: 0.1-mile past intersection with FM-686 about 6 miles west of City of Dayton and US-90
BMT05	JASPER	US-96: 0.1-mile past intersection with FM-2800
BMT06	JEFFERSON	IH-10: near exit for FM-365
BMT07	TYLER	US-69: 0.1-mile past intersection with FM-1013 in Town of Hillister
BMT08	HARDIN	US-69: 0.4 miles past intersection with SH-327 approaching City of Lumberton

District	County	Site Location
BMT09	NEWTON	SH-87: 0.3 miles past intersection with FM-253
BRY01	FREESTONE	IH-45: 200 feet past intersection with SH-179 east of Teague about 42 miles south of Corsicana
BRY02	BURLESON	FM-50: 0.1-mile past intersection with FM-1361, west of SH-6 and Mustang Hills, northeast of Somerville
BRY04	WASHINGTON	US-290: 0.1-mile past Loop 2447
BRY05	BURLESON	FM-1362: 0.1-mile past intersection with SH-21
BRY06B	BRAZOS	FM-2038: 0.1-mile past Marker 628
BRY07	GRIMES	SH-90: 0.1-mile past intersection with SH-6 before Sonic on left.
BRY08	MADISON	SH-75: 0.1-mile past intersection with Old San Antonio Road near IH-45
BRY09	ROBERTSON	US-79: 0.3 miles past intersection with FM-46 in Town of Franklin
BRY10	WASHINGTON	FM-50: 0.5 miles past intersection with FM-390, north of SH-105 in between Brenham and Navasota
BWD01	BROWN	US-67/US-377: 0.1-mile northwest of intersection with FM-1467, traveling northwest
BWD02	COMANCHE	SH-16: 0.1 mile southeast of intersection with FM-R 3200, traveling southeast from Comanche
BWD03	BROWN	US-183: 0.4 miles north of intersection with US-67, traveling north from Brownwood
BWD04	COMANCHE	FM-587: 0.5 miles east of intersection with Co Rd 679 in COMANCHE COUNTY traveling east toward De Leon Municipal Airport
CHS01	KING	US-82/SH-114: about 2250 feet northeast of intersection with US-83 near Guthrie
CHS02	KNOX	US-277: about 1000 feet west of intersection with FM-266 in Town of Goree
CHS03	KNOX	SH-256: about 0.5 miles northwest of intersection with US-83
CRP01	LIVE OAK	IH-37: near FM-799
CRP02	NUECES	SH-358: near IH-37
CRP04	NUECES	US-77: near FM 892 (Lincoln Ave) between Mobil station and Days Inn
CRP05	REFUGIO	US-183: near SH-202
CRP06	BEE	SH-359: near US-181
CRP07	LIVE OAK	IH-37: near Mile Marker 47 & 48 near Mustang Creek.
CRP08	GOLIAD	US-183/US-77: 0.3 miles past intersection with SH-239
CRP09	REFUGIO	US-77: near FM-774 at Town of Refugio

District	County	Site Location
CRP10	BEE	SH-202: 0.4 miles past intersection with FM-2441
CRP11	KLEBERG	FM-771: about 800 feet west of CR-1080
DAL01	COLLIN	SH-121/Sam Rayburn Hwy: 0.3 miles north of intersection with FM-2933/Co Rd 1116, 2-3 miles traveling northeast from US-75 and Melissa
DAL02	COLLIN	SH-78: 0.3 miles west of intersection with SH-205, north of Lake Ray Hubbard and I-30, west of Plano, traveling west
DAL03	DALLAS	IH-35E/US-77 Service Road near Valwood Parkway
DAL04	DALLAS	IH-20: 0.1 mile west of intersection with FM-1382, about 6.5 miles west of US-67, traveling east from Fort Worth
DAL05A	DALLAS	IH-20: 0.1 mile east of intersection with IH-45, traveling east
DAL06	ELLIS	US-287: 0.6 miles southwest of intersection with US-67, traveling southeast, south of Midlothian, near Crossroads Lake
DAL08	KAUFMAN	IH-20: 0.3 miles east of intersection FM-2932, near FM-741, about 15 miles west of IH-635, traveling east
DAL09	KAUFMAN	IH-20: 0.3 miles southeast of intersection FM-2965, traveling northwest toward Dallas, about 11 miles southwest of Terrell Airport
DAL10	KAUFMAN	US-175: 0.3 miles southeast of intersection with US-175 Business, north of Mabank, east of Cedar Creek Reservoir, traveling southeast
DAL11	KAUFMAN	SH-274: 0.3 miles south of intersection with FM-148, traveling north toward Kaufman
DAL12	NAVARRO	IH-45: 2 miles south of exit 242, traveling south
DAL13	NAVARRO	US-287: 0.3 miles east of intersection with FM-3243, traveling southeast from Corsicana, near Campbell Field-Corsicana Airport
DAL14	NAVARRO	SH-22: 0.1 mile west of intersection with FM-1839, traveling west from Corsicana (about 5-6 miles)
DAL15	ROCKWALL	IH-30: 0.1 miles east of intersection with FM-740 on left-hand side of road
DAL16	ELLIS	IH-45/US-287: 0.1 mile north of intersection with FM-1182, near ELLIS/NAVARRO COUNTY lines, traveling south toward Corsicana
DAL17	DENTON	US-380: 0.1 mile west of intersection with FM-156, 7.5 miles west of Denton, traveling west
DAL18	DENTON	FM-720 (Little Elm Parkway) 0.1 mile west of intersection with FM-423

District	County	Site Location
DAL19	NAVARRO	IH-45: 0.1 mile southeast of intersection with FM-1394/Ranch RD-1934, traveling about 12.5 miles south from Corsicana
DAL21	DALLAS	US-175 near Pine Street
DAL22	DALLAS	SH-356: 0.1 mile south of intersection with SH-183, traveling south
DAL23	ROCKWALL	SH-276: 0.1 mile east of intersection with FM-548, about 6.5 miles east of IH-30/US-67, traveling east from Dallas
DAL24	DALLAS	IH-30: 0.1 mile east of Exit 34, traveling west
DAL25	COLLIN	US-75 Service Road and TX Spur 399 traveling north near Gateway Blvd.
DAL26	DENTON	FM-455/Chapman Road: 0.2 miles west of intersection with IH-35/US-77, traveling west, near Lake Ray Roberts, about 11.5 miles north of Denton
ELP01	REEVES	IH-10: near exit 184 0.1 miles past int. with IH-20 about 3600 feet west of Fort Davis rest area
ELP02	EL PASO	US-54: 0.1 mile before Texas-New Mexico State line at Welcome to El Paso sign
ELP04	EL PASO	IH-10: 0.1-mile past Spur 375
ELP05	JEFF DAVIS	SH-17: 0.1-mile past int. with Front Street in area of Fort Davis
ELP06	EL PASO	IH-10: 0.1-mile past Exit 42 near intersection with FM-1100/Clint-San Elizario/Darrington Rd
ELP07	HUDSPETH	US-180/US-62: about 1100 feet west of intersection with FM-659/N Zaragoza Road
ELP08	PRESIDIO	US-67: about 1.5 miles south of intersection with US-90 in Town of Marfa
ELP09	BREWSTER	SH-118: about 200 feet past intersection with US-67/90
ELP10	JEFF DAVIS	SH-17: 0.5 miles past int. with US-118
FTW01	JOHNSON	US-67: 0.1 miles west of FM-2331, traveling about 7.5 miles west from Cleburne.
FTW02	JOHNSON	SH-171: 0.1 mile south of JOHNSON COUNTY Line traveling south
FTW03	JOHNSON	FM-2331: 0.1 mile south of intersection with FM-4, southwest of SH-171 and northwest of US-67 and City of Cleburne
FTW04	PALO PINTO	IH-20: 0.1 mile east of intersection with SH-193 traveling east
FTW05	PARKER	IH-20: 0.1-mile northeast of intersection with FM-113/Fannin St./N Plum St about 5 miles south of Millsap, traveling north
FTW06	PARKER	SH-199: 0.1 mile south of intersection with FM-2257 traveling south

District	County	Site Location
FTW07	PARKER	SH-171: 0.1 mile south of intersection with FM-51 traveling south
FTW08	TARRANT	IH-30 East near Exit 32A sign for 161
FTW09	TARRANT	IH-20 East: 0.1 mile east of intersection with SH-360, east of Fort Worth traveling east
FTW10	JOHNSON	IH-35 west: 0.2 miles north of intersection with FM-917 traveling north
FTW11	SOMERVELL	US-67: 0.1 mile west of intersection with FM-199 traveling west.
FTW12	PALO PINTO	IH-20: 0.1 mile west of intersection with US-281 traveling southwest
FTW13B	JACK	FM-2210: 0.1 mile north of intersection with SH-199 traveling north
FTW14	PALO PINTO	SH-16: 0.1 mile north of intersection with FM-207 traveling north
FTW15	JOHNSON	IH-35W traveling north past FM 604
FTW16	JOHNSON	IH-35E: at intersection with Exit 391
FTW17	HOOD	US-377: 0.2 miles south of intersection with SH-171 traveling south
HOU03	HARRIS	SH-529/Spencer Road: 0.1-mile past intersection with SH-6
HOU04R	HARRIS	IH-10: 0.1-mile past Exit 741 near intersection with Katy Fork Bend Road
HOU05	HARRIS	IH-45: 0.1-mile past intersection with W Parker Road and E Little York
HOU06	HARRIS	IH-45: 0.1-mile past intersection with FM-2920
HOU07	HARRIS	IH-10: 0.1-mile past Pine Oak Road
HOU08	HARRIS	I-69 (formerly US 59 and 288) south of I-45
HOU09	HARRIS	SH-288: 0.1-mile past intersection with US-90A past Houston
HOU11	MONTGOMERY	FM-2854 in front of CVS: 0.1-mile past intersection with SH-105
HOU12	HARRIS	IH-10 Frontage Road Under Overpass near Gessner Road
HOU13R	HARRIS	IH-10 between Frontage Road and Interstate past intersection with SH-99/Grand Parkway
HOU14	HARRIS	US-90: 0.1-mile past intersection with SH-8, near FM-2100
HOU15	WALLER	IH-10: 0.1-mile past WALLER COUNTY Line
HOU16	WALLER	US-290: 100 past WALLER/WASHINGTON COUNTY Line
HOU17	MONTGOMERY	SH-249: 0.1-mile past HARRIS/MONTGOMERY COUNTY Line
HOU18	MONTGOMERY	IH-45: 0.1 mile past the HARRIS/MONTGOMERY COUNTY line, near The Woodlands
HOU21	MONTGOMERY	FM-1314: 0.1-mile past intersection with SH-242
HOU22	MONTGOMERY	FM-2090: 0.1-mile past intersection with US-59 near Splendora

District	County	Site Location
HOU25	FORT BEND	SH-36: 0.1-mile past intersection with between FM-361, near City of Needville
HOU26	GALVESTON	IH-45 (5470 Gulf Freeway) past W Hughes Road
HOU27	MONTGOMERY	IH-45: 0.1-mile past intersection with FM-830/1097
HOU28	FORT BEND	US-59: 0.1-mile past Williams Way/Richmond Parkway
HOU29	FORT BEND	US-59/Main Street: parallel to TX-541
HOU30	HARRIS	IH-10 Frontage ROW next to JC Penny's
HOU31	GALVESTON	IH-45/Gulf Freeway: past intersection with SH-275
HOU32	MONTGOMERY	SH-105: 0.1-mile past intersection with Millmac Rd in City of Cut and Shoot
HOU33	GALVESTON	SH-146: 0.1-mile past intersection with SH-197/25th Avenue North adjacent to Moses Lake
HOU34	FORT BEND	FM-723: 0.1-mile past intersection with FM-359 about 10 miles south of I-10
HOU35	BRAZORIA	FM-2004: near intersection with FM-523, several miles east of SH-288, north of City of Angleton
HOU36	WALLER	FM-1488: 0.1-mile past intersection with FM-1736, past US-290 and SH-6, near City of Hempstead
HOU37	HARRIS	IH-10: 0.1-mile past intersection with FM-526 near Exit 778
HOU38	MONTGOMERY	IH-45: 25 feet past Exit 103 near FM-1375
HOU39	FORT BEND	SH-36 (14623 TX-36): 0.5 miles past intersection with FM-442 near City of Needville
LRD01	KINNEY	US-90: northwest of FM-693, about 1-2 miles north of Brackettville
LRD02	LA SALLE	IH-35: near FM-468 (near Mile Marker 67)
LRD03	LA SALLE	IH-35: about a mile north of SR 44 near the southwest border of LA SALLE COUNTY
LRD04	WEBB	IH-35: near Mile Marker 24
LRD05	KINNEY	US-90: about 1200 feet northwest of FM-1572
LRO06	VAL VERDE	SH-163: about 500 feet northeast of intersection with US-90
LRD07	DIMMIT	SH-85: about 500 feet west of intersection with FM-65 in Town of Brundage
LBB01	HOCKLEY	SH-114/FM-303: 700 feet from intersection where FM-303 turns right and FM-114 continues straight near Levelland
LBB02	LUBBOCK	FM-179/Dowden Rd: 650 feet north of intersection with US-82/US-62/Brownfield Hwy in Wolfforth

District	County	Site Location
LBB03	TERRY	US-385: about 525 feet south of intersection with FM-280/FM-2196
LBB04	LUBBOCK	IH-27: near exit 13/14 near New Deal Mobile Home Community
LBB05	SWISHER	IH-27: near sign for Exit 21 to FM 597/Main Street
LBB06	CASTRO	SH-194: about 320 feet south of intersection with US-385 and FM-514 south of Town of Dimmitt
LBB07	LYNN	FM-1054: 2100 feet north of intersection with FM-213/FM-33 near Town of Draw
LBB08	FLOYD	FM-788: about 1800 feet east of intersection with FM-2301 about 10+ miles east of IH-27/US-87 near Plainview
LFK03	SAN JACINTO	US-59 (I-69): 0.1-mile past LIBERTY COUNTY Line
LFK04	POLK	SH-146: 0.1-mile past City of Livingston ETJ (Extra Territorial Jurisdiction)
LFK06	SHELBY	US-84: 0.1-mile past intersection with FM-1970 near Timpson
LFK07	SAN AUGUSTINE	FM-2213: 0.1-mile past intersection with Texas Avenue south of City of San Augustine Line near US-96 and SH-147
LFK08	NACOGDOCHES	US-259: 0.1-mile past intersection with US-59 (I-69) near Stephen F. Austin University
LFK09	HOUSTON	US-287: 0.2 miles past intersection with FM-227
LFK10	ANGELINA	SH-63: 0.3 miles past intersection with SH-147
ODA01	ECTOR	IH-20: about 1750 feet southwest of intersection with US-385
ODA03	WINKLER	SH-18: about 13.7 miles north of I-20 in between FM-306 and FM-404
ODA04	PECOS	US-285: about 2500 northwest of intersection with FM-1776
ODA05	MIDLAND	IH-20: near Exit 137 past FM 1180
ODA06	ECTOR	IH-20: near exit 101 and about 1500 feet southwest of FM-1601/Avenue C
ODA07	WARD	US-285: about 2000 feet southeast of intersection with FM-1450
ODA08	MARTIN	SH-176: 1150 feet past intersection with SH-349 near Town of Tarzan
ODA09	PECOS	SH-18: about 1800 feet north of intersection with IH-10
PHR01	BROOKS	US-281: past intersection of FM-3066/Baluarte Creek Road near Brooks County Airport
PHR02	HIDALGO	SH-107: near FM-493/LaBlanca Road
PHR03	WILLACY	FM-1762/Co Rd 3401 near US-77 business
PHR04	STARR	US-83: near North Blanca Road south of Rio Grande City
PHR05	BROOKS	US-281: near FM-1418

District	County	Site Location
PHR06	HIDALGO	FM-490: past the intersection of FM-1425 near Raymondville
PHR07	BROOKS	US-281: near FM-755, near Town of Rachal about 53 miles north of McAllen
PHR08	ZAPATA	US-83: about 3200 feet north of intersection with FM-2687 near Town of Lopeno
PHR09	CAMERON	US-83: near Guadalupe Flores Road near Sullivan City, near Town of Lopeno
PHR10	WILLACY	SH-186: about 200 feet east of FM-1420
PHR11	BROOKS	FM-755: about 0.5 miles past intersection with US-281
PAR01	LAMAR	US-82: 0.1 mile south of intersection with FM-38 traveling south
PAR02	LAMAR	SH-19: 0.1 mile north of the DELTA COUNTY Line traveling north
PAR04	HOPKINS	IH-30W: 0.1 mile east of intersection with SH-19 in Sulphur Springs city limit near Exit 122, traveling east
PAR05	RED RIVER	FM-114: 0.1 mile east of intersection with FM-44, past Town of Annona, near US-82 northwest of New Boston traveling east
PAR06	HOPKINS	IH-30: 0.1 mile west of Exit 137 traveling east
PAR07	RED RIVER	SH-37: 0.5 miles north of intersection with US-82 in Clarksville, about 41 miles north of IH-30 and Mt. Pleasant, traveling south
PAR08	LAMAR	FM-195: 0.1 miles north of intersection with FM-2648 & FM-906 about 10 miles east of US-271, 10 miles south of SH-109, north of US-82, traveling north from Paris
SAT02	COMAL	IH-35: 9505 S I-35 Frontage Road
SAT03	BEXAR	SH-16: near IH-410 Loop next to Valero
SAT05	COMAL	FM-3009/Market Rue: near FM-2252, about 2 miles north of I-35
SAT06	BEXAR	US-181: near SH-122
SAT07	BEXAR	US-87: near FM-1628 (Stuart Road), near IH-410 Loop
SAT08	BEXAR	IH-35: near BEXAR/ATASCOSA COUNTY Line, 6 miles southwest of FM-Loop 1604
SAT09	BEXAR	IH-10/US-90: near FM-1518, near FM-1604 in City of Adkins past San Antonio
SAT10	GUADALUPE	SH-123/Guadalupe St: near Rattler Road
SAT11	KERR	IH-10: near Old Cypress Creek Road, about 2500 feet north of Exit 523
SAT12	MCMULLEN	SH-72: 530 feet west of SH-16
SAT13	GUADALUPE	IH-10: about1.1 miles northeast of FM-1104 north of US-90

District	County	Site Location
SAT14	ATASCOSA	IH-37/US-281: about 2000 feet north of FM-1099 near Town of Campbellton
SAT15	FRIO	FM-140 past Louise/Trevino Street in front of Hampton Inn
SAT16	FRIO	IH-35: near Exit 111 near US-57
SAT17	BEXAR	IH-410 Access Road: near Southton Road near Exit 41
SAT18	FRIO	US-57: about 450 feet northeast of intersection with FM-140
SJT02	TOM GREEN	US-87: about 950 feet past intersection with FM-2105 northeast of San Angelo
SJT03	IRION	FM-853: about 650 feet north of intersection w/ US-67
SJT04	CROCKETT	IH-10: 0.1-mile past Exit 372 about 1950 feet northeast of intersection with FM-101/Taylor Road
SJT05	IRION	SH-163/N Main St: about 720 feet northeast of intersection with US-67 near Barnhart Volunteer Fire Dept.
TYL01	CHEROKEE	FM-747: 0.5 miles south of intersection with US-79, traveling north toward Jacksonville, near US-175
TYL02	GREGG	SH-300: 3.0 miles north of Spur 281 traveling north
TYL03	HENDERSON	SH-19: 100 south of intersection with FM-2709 traveling about 7 miles north from Athens
TYL04	SMITH	US-69: 0.1 mile south of intersection with IH-20, about 10 miles north of Tyler, traveling south
TYL05	VAN ZANDT	IH-20: 0.1 mile southeast of intersection with FM-1255, traveling southeast from Canton
TYL06	RUSK	US-259: 0.1 mile south of intersection with FM-3310, about 3.5 miles south of US-79/US-259 intersection, traveling south from Henderson
TYL07	VAN ZANDT	US-80: 1.5 miles east of intersection with SH-19 about 13 miles north of City of Canton traveling east
TYL08	CHEROKEE	FM-241: 0.1 mile north of intersection with SH-21 traveling north toward Rusk, northwest of Nacogdoches
TYL09	SMITH	FM-849: 0.2 miles north of intersection with IH-20 Exit 552 traveling north
TYL10	SMITH	FM-850: 0.1 miles west of intersection with SH-31 near Headache Springs Natural Park traveling west
WAC03	MCLENNAN	US-84: 0.1-mile past intersection with SH-317 near MCLENNAN/CORYELL COUNTY Line
WAC04	MCLENNAN	SH-6: 0.1-mile past intersection with FM-185 across from Sunoco

District	County	Site Location
WAC05	MCLENNAN	IH-35: 0.1-mile past intersection with FM-308 (West Elm Mott Lane) near FM-3149
WAC06	BOSQUE	FM-2490: 0.1-mile past intersection with RC Granger Rd/CR 3650 near MCLENNAN COUNTY Line, 20 miles west of IH-35/US-77
WAC07	MCLENNAN	IH-35: 0.1-mile past N Pecan Street past Town of Hillsboro, past intersection with US-77/Abbott Ave
WAC08	HAMILTON	SH-22: 0.1-mile past intersection with FM-1602 near Cranfills Gap
WAC09	HILL	IH-35: 0.1-mile past intersection with FM-1242 (Pine Street) near Exit 358 and City of Abbott
WAC10	MCLENNAN	IH-35: 0.1-mile past intersection with FM-434 near Exit 335A
WAC11	CORYELL	US-84: 0.3 miles past intersection with FM-116
WAC12	BOSQUE	SH-22/Morgan Street: 0.5 miles past intersection with SH-6 and SH-124 right before North Bosque River
WFS01	COOKE	IH-35/US-77: 0.1 mile south of intersection with FM-1306/Co Rd 218 near Exit 494 traveling south from Gainesville toward Denton
WFS02	WICHITA	US-287/Old Iowa Park Rd: 750 feet west of intersection with FM-369, traveling west from Wichita Falls/IH-44 area toward Wichita Valley Airport
WFS03	WICHITA	IH-44: 3 miles north of intersection with US-287, just south of the Texas/Oklahoma border, traveling south
WFS04	ARCHER	FM-368: 0.1 mile north of intersection with US-277/US-82, traveling south past City of Wichita Falls
YKM01	JACKSON	US-59: near FM-234
YKM02	VICTORIA	SH-185: near US-59 south of Victoria
YKM03	WHARTON	FM-102: near US-59
YKM04	AUSTIN	IH-10: about 2500 feet NE of SH-36
YKM05	FAYETTE	IH-10: Near CR-240 and near Exit 682
YKM06	LAVACA/COLORADO	FM-155: past intersection with US-90 Alt.
YKM07	VICTORIA	FM-616: near US-87 south of Victoria

APPENDIX D – MAPS

Maps Previewed in the Report

Map 1 – Sites Distribution

Map 2 – Large Litter Heat Map

Map 3 - Micro Litter Heat Map

Map 4 - TxDOT Districts and Regions

Site Maps by Region

Map 5 – North Region Districts

Map 6 – South Region Districts

Map 7 – East Region Districts

Map 8 – West Region Districts

Return to Text

-1180 0000 -1160 0000 -1140 0000 -1120 0000 -1100 0000 -1080 0000 -1060 0000 -1040 0000

440 0000 420 0000 400 0000 380 0000 360 0000 340 0000 320 0000 300 0000

Oklahoma

Tulsa

Oklahoma City

Santa Fe

Albuquerque

New Mexico

AMA

CHS

LBB

WFS

PAR

ATL

FTW

DAL

TYL

ABL

BWD

WAC

LFK

BRY

ODA

SJT

ELP

AUS

BMT

HOU

SAT

YKM

LRD

CRP

PHR

Chihuahua

Torreón

Saltillo

Monterrey

Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA

N

0 25 50 100 Miles

Legend

Districts by Region

- North
- South
- East
- West
- County Boundaries
- Litter Survey Sites

July 2023

2023 Texas Litter Survey

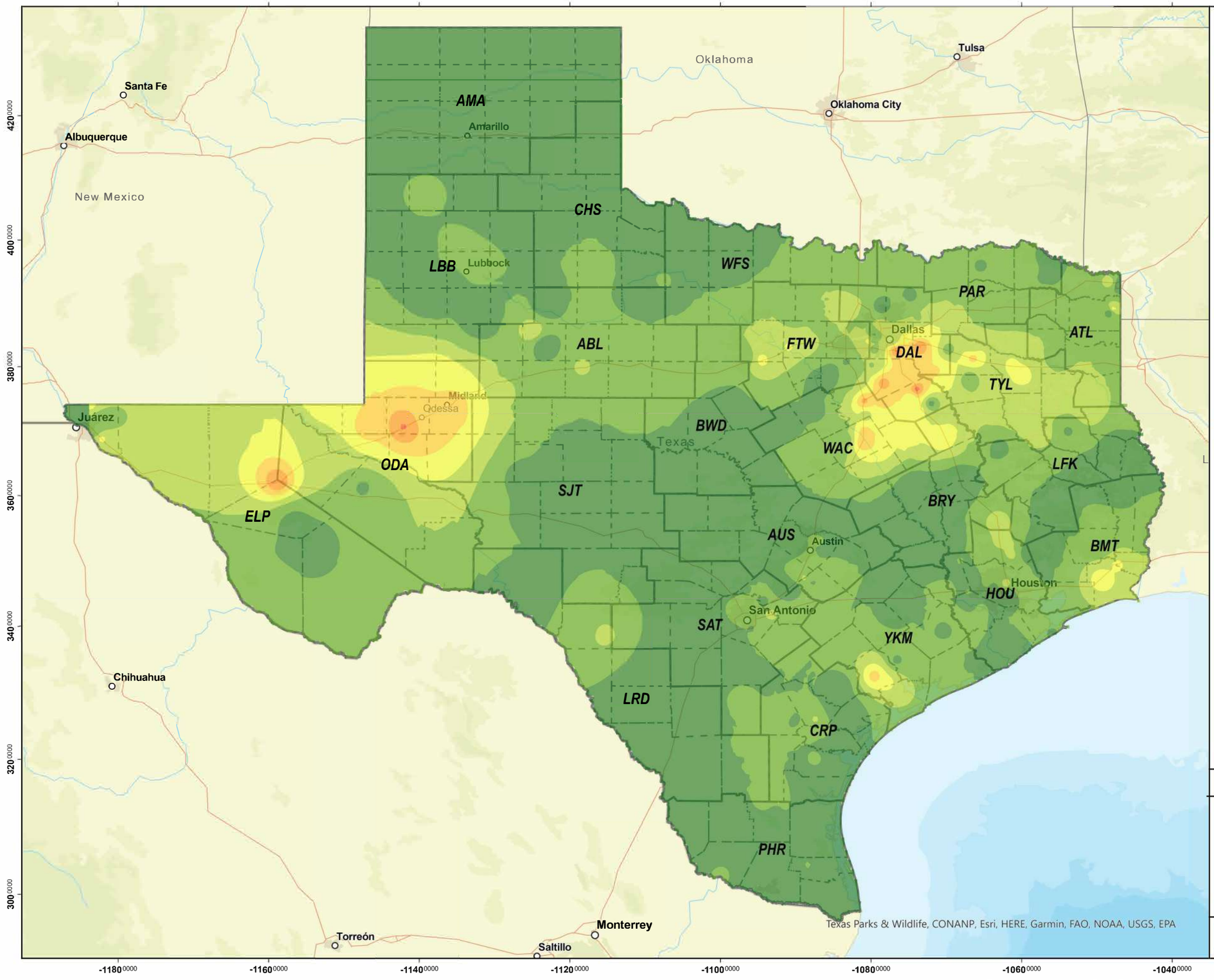
Don't Mess with Texas®

Litter Survey Sites

TETRA TECH

Figure 2

Return to Text



N

0 25 50 100 Miles

Legend

County Boundaries

Litter Survey - Total Number of Large Items Identified

- 0 - 30
- 31 - 60
- 61 - 90
- 91 - 120
- 121 - 150
- 151 - 180
- 181 - 210

July 2023

2023 Texas Litter Survey

Don't Mess with Texas®

Street Litter Intensity

TETRA TECH

Figure 7

Return to Text

-1180 0000 -1160 0000 -1140 0000 -1120 0000 -1100 0000 -1080 0000 -1060 0000 -1040 0000

420 0000 400 0000 380 0000 360 0000 340 0000 320 0000 300 0000

Oklahoma

Tulsa

Oklahoma City

Santa Fe

Albuquerque

New Mexico

Amarillo

Lubbock

Dallas

Midland

Odessa

Juárez

Texas

Austin

San Antonio

Houston

Chihuahua

Monterrey

Torreón

AMA

CHS

LBB

WFS

PAR

ATL

ABL

FTW

DAL

TYL

BWD

WAC

LFK

ODA

SJT

BRY

ELP

AUS

BMT

HOU

SAT

YKM

LRD

CRP

PHR

0 25 50 100 Miles

Legend

County Boundaries

Litter Survey - Total Number of Small Items Identified

- 0 - 1,500
- 1,501 - 3,000
- 3,001 - 4,500
- 4,501 - 6,000
- 6,001 - 7,500
- 7,501 - 9,000
- 9,001 - 10,800

July 2023

2023 Texas Litter Survey

Don't Mess with Texas®

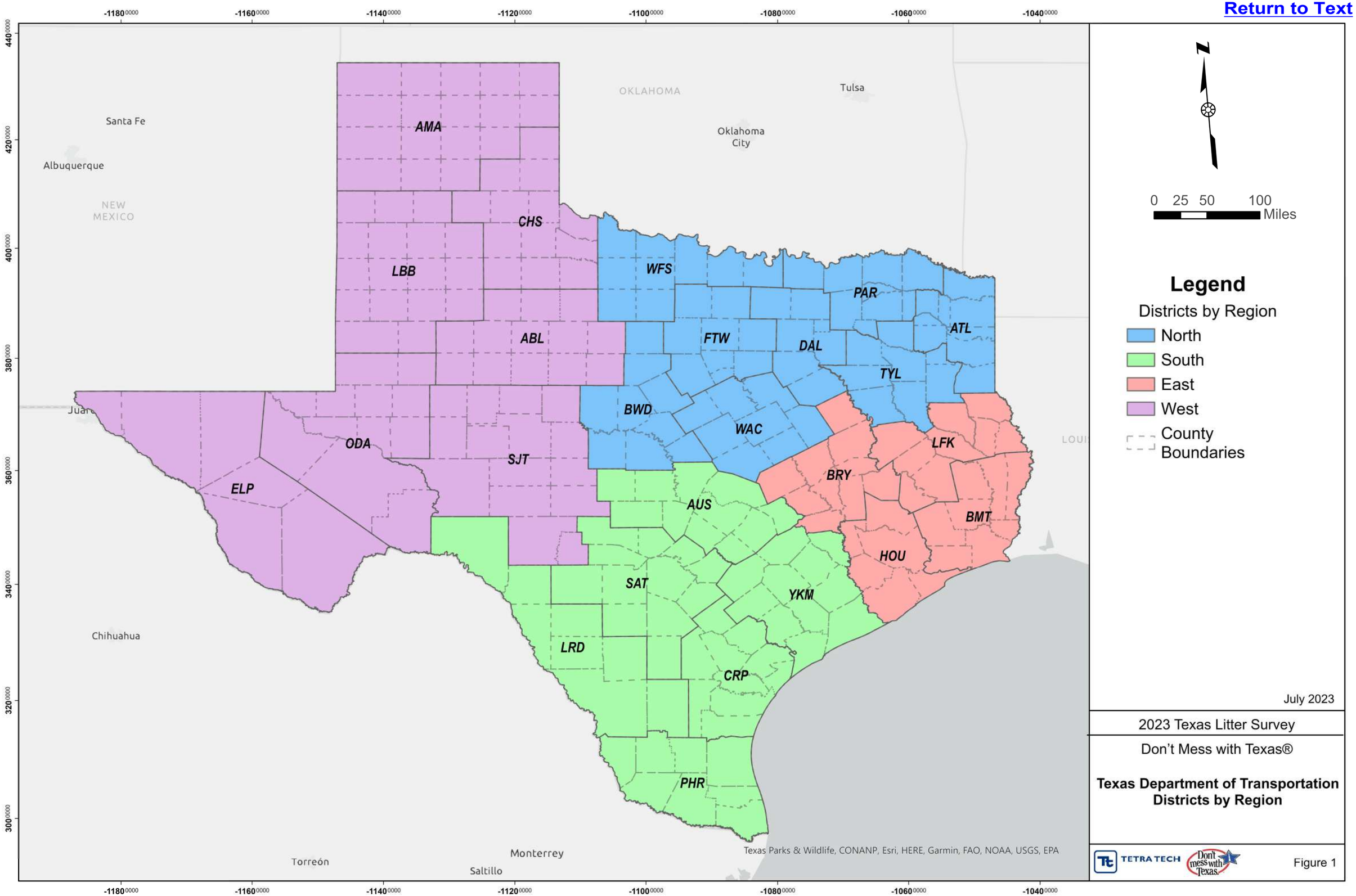
Small Litter Intensity

Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA

TETRA TECH

Figure 8

Return to Text



July 2023

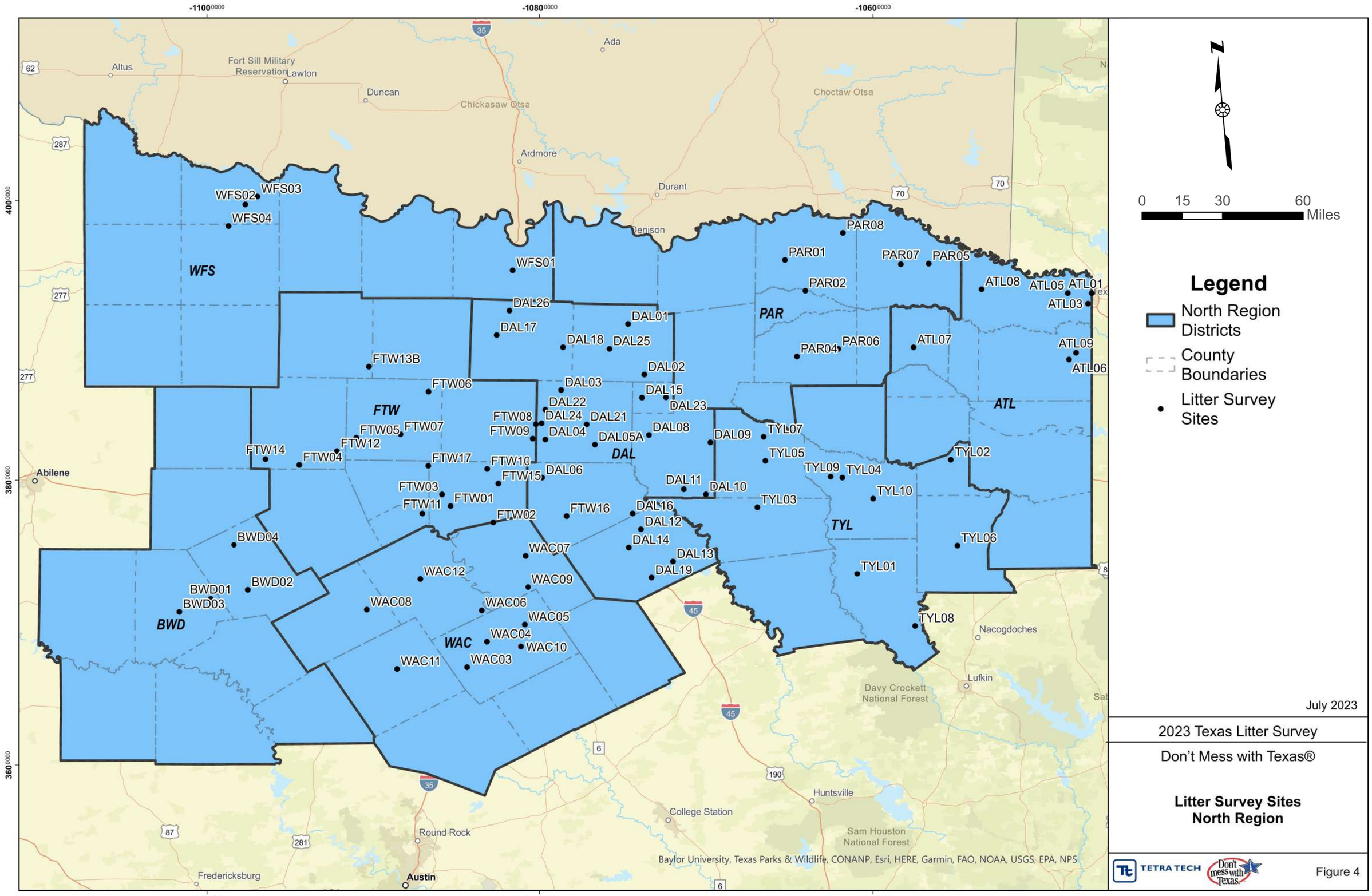
2023 Texas Litter Survey

Don't Mess with Texas®

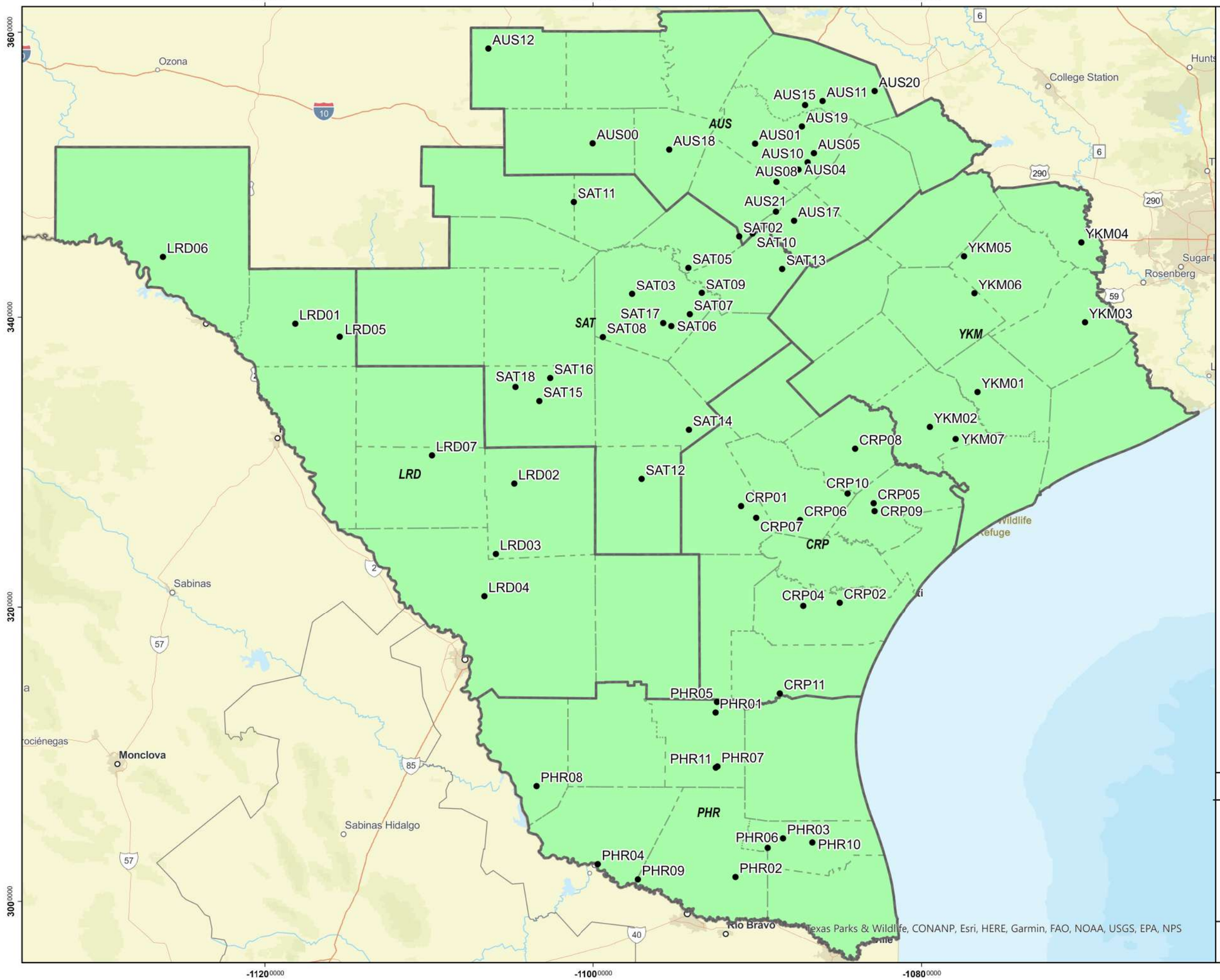
Texas Department of Transportation Districts by Region

TETRA TECH

Figure 1



The data on the map is derived from Tetra Tech. Tetra Tech is not liable for positioning inaccuracies, subsequent updates, errors, or omissions of data. However, suggestions for improvement or error notifications are welcome.

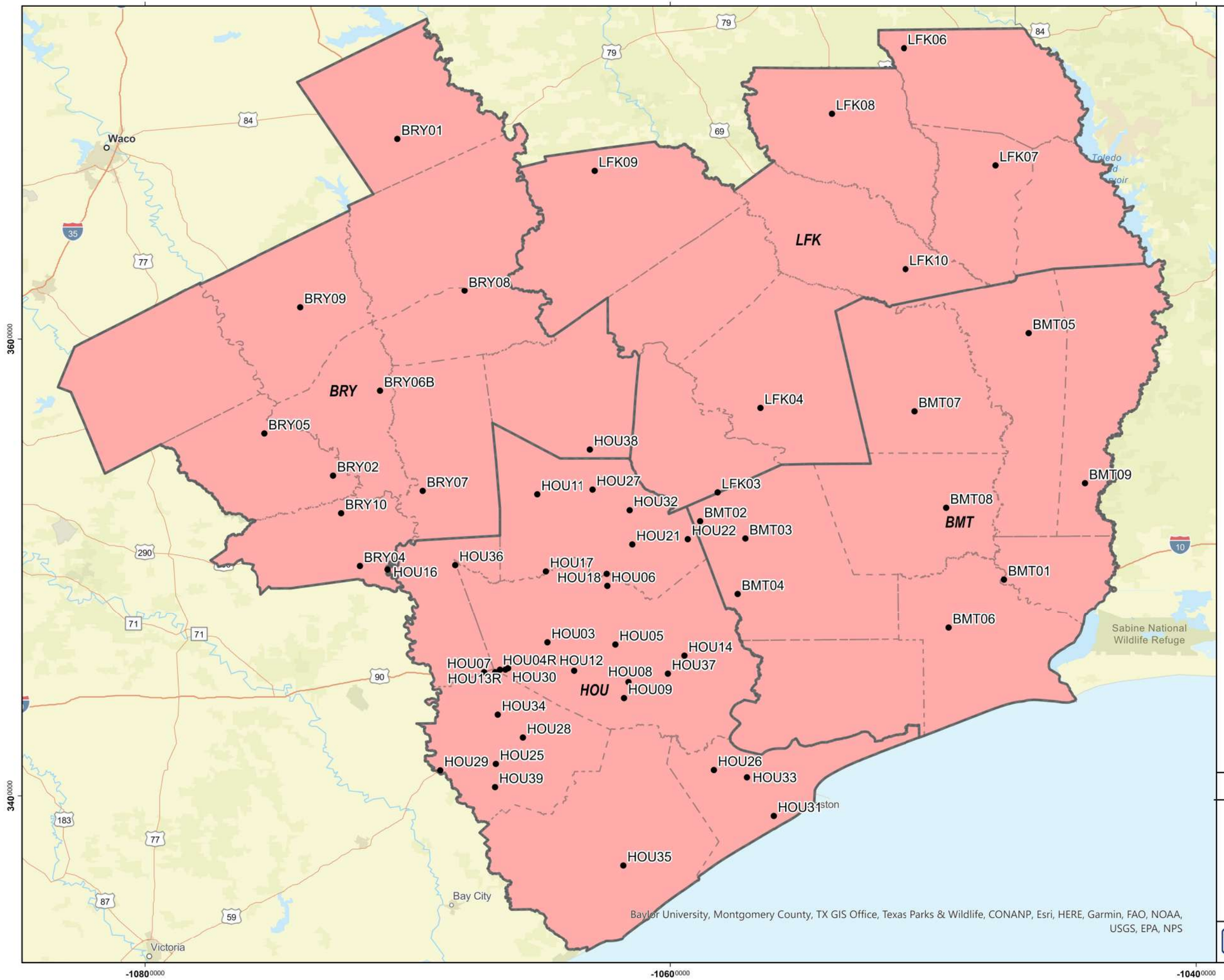


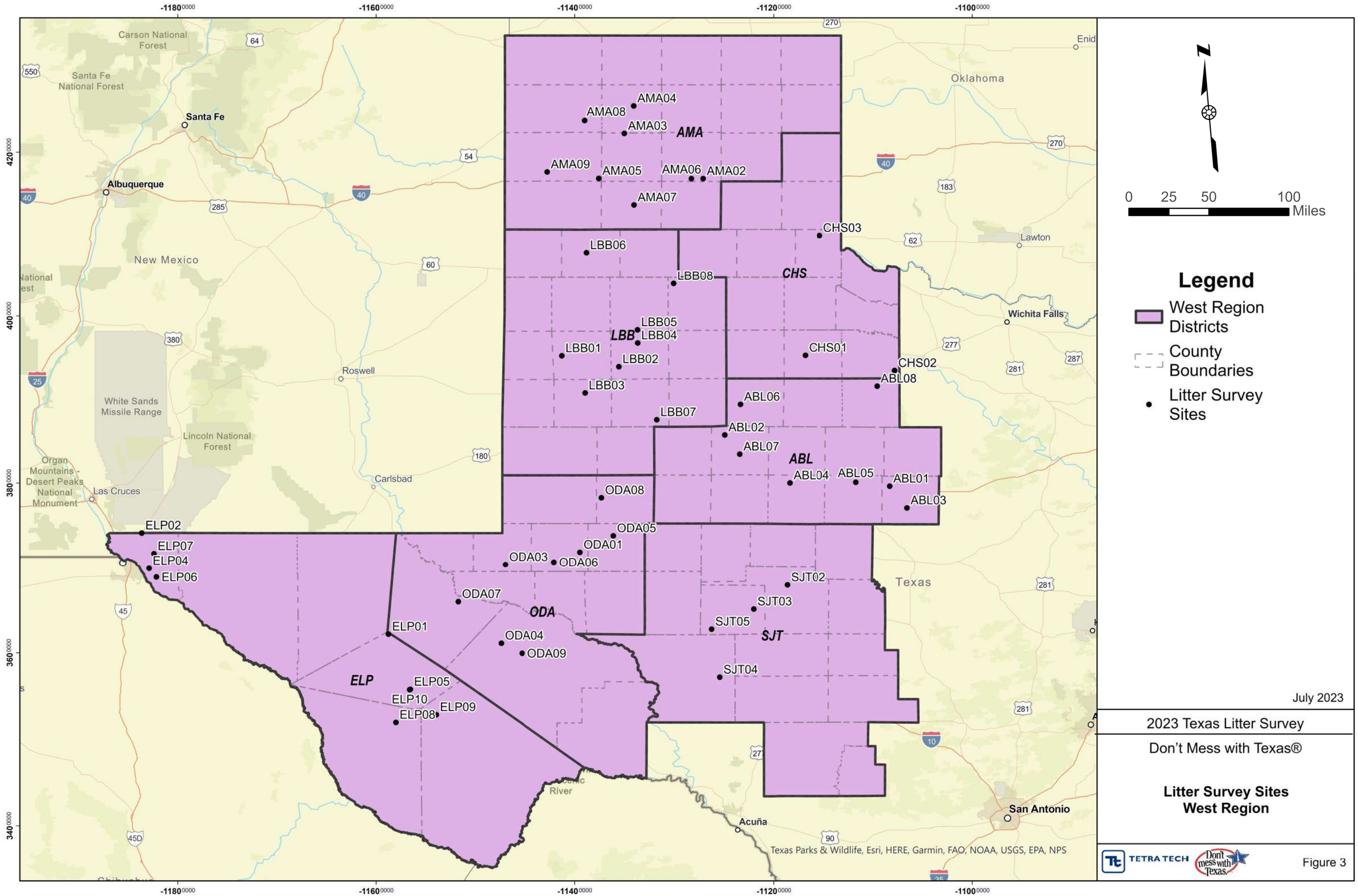
The data on the map is derived from Tetra Tech. Tetra Tech is not liable for positioning inaccuracies, subsequent updates, errors, or omissions of data. However, suggestions for improvement or error notifications are welcome.

-1080 0000 -1060 0000 -1040 0000

360 0000

340 0000





The data on the map is derived from Tetra Tech. Tetra Tech is not liable for positioning inaccuracies, subsequent updates, errors, or omissions of data. However, suggestions for improvement or error notifications are welcome.

APPENDIX E –PROJECT TEAM BACKGROUND

The Tetra Tech Project Team (Project Team) which performed the 2023 Large Litter Survey (VLS) consisted of litter and marine debris experts from Tetra Tech BAS, Inc., Environmental Resources Planning (ERP), and Carson Consulting. Christian Ferguson with Tetra Tech BAS, Inc. was the lead Project Manager and has 21 years of experience conducting land-based litter surveys and marine debris studies both in North America and Southeast Asia. Steven R. Stein with ERP has led more than 20 state-wide and regional litter surveys nationwide. Cecile Carson, E.d.D., with Carson Consulting was the former Keep America Beautiful Vice President of Litter and Affiliates and the Keep Texas Beautiful Director of Affiliates. She has participated in more than 1,000 roadway litter assessments.

ERP staff have led surveys, studies or analytics for litter projects in the Anacostia Watershed, Georgia, Honolulu, Maine, Malibu, Minnesota, New Hampshire, New Jersey, North Carolina, Oakland, Ohio, Rhode Island, San Francisco, Santa Monica, Tennessee, Texas, Toronto, Utah, Vermont, Virginia and Washington, D.C. in addition to leading the Keep America Beautiful 2009 National Litter Survey and Litter Cost Study.

Field crews under the Project Team's direction have surveyed more than 44 million feet of roadways and recreational areas across North America. Senior staff have authored a number of key litter-related publications including "Litter: Literature Review" for Keep America Beautiful and various marine debris guidebooks for the United States Agency for International Development's Clean Cities, Blue Ocean program. Our litter-related work has been featured in National Geographic, Time Magazine, and the New York Times as well as on NPR and ABC's Good Morning America.

The 2023 Texas Litter Survey was led by Christian Ferguson and Steven R. Stein, who also led the field work planning and developed the draft and final reports. The physical surveying of litter on the 253 site locations was performed by key Carson Consulting staff members. The statistical aspects of this project were overseen by Dr. Ron Visco of ERP, who holds a Ph.D. in Research Design and Statistics.