

Citizen Collected Evidence: Environmental Defense Fund Post-Harvey Monitoring Houston and Port Arthur Areas, TX

October 3, 2017

Background

Landfall of Hurricane Harvey on August 25, 2017, and subsequent stalling of the system over south Texas, caused unprecedented flooding in the Houston Region. As a result, several industrial facilities were damaged. An example of this includes the Valero Refinery near the Manchester Community. A floating roof tank suffered failure due to heavy rainfall experienced at the facility. This subsequently led to a spill of light crude from this tank; light crude is a mixture of volatile organic compounds (VOCs). Valero has reported to the Texas Commission on Environmental Quality (TCEQ) and United States Environmental Protection Agency (EPA) that it is removing residual crude material from the damaged tank. After the spill, Valero began spraying the exposed light crude with foam suppressant to minimize emissions from the VOCs. Cleanup and repairs are on-going.

EDF Contractor Mobile/Static Data

The Environmental Defense Fund (EDF) partnered with a California-based company, Entanglement Technologies, Inc. (Entanglement), to conduct mobile and static sampling in the Houston area, as well as in the Port Arthur area. Specifically, the Manchester neighborhood in Houston was a particular focus of sampling efforts. Based on the data provided to TCEQ, intermittent sampling was conducted for various periods of time on September 4 through 9, 2017 ranging anywhere from approximately 8:23 am to 9:47 pm over the duration of the sampling days.

Data Timeline

Preliminary Data

TCEQ first became aware of this data via reports in news articles, such as the Wall Street Journal article on September 5, 2017, *After Oil Refinery Is Damaged by Harvey, Benzene Is Detected in Houston Area*, and in speaking with the City of Houston on September 6, 2017. A fraction of the preliminary data from the Manchester area were shared with TCEQ from the City of Houston on September 9, 2017. TCEQ requested a copy for evaluation from EDF on September 12, 2017. EDF shared the preliminary data from Port Arthur with TCEQ September 13, 2017.

Validated Data

TCEQ requested the final dataset on September 14, 2017 and EDF shared the validated data that day. After review of the validated data, TCEQ noticed several discrepancies and contacted EDF for clarification on September 15, 2017 (see Appendix A: Time-line of Discrepancies with Validated Data for more detail). A conference call we set up between EDF, Entanglement, and TCEQ to discuss the issues. It was noted by Entanglement that latitude/longitude coordinates had somehow gotten mixed up and were not associated with the appropriate data. It was also

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noted by Entanglement that the validated data file sent to TCEQ did not match the file shared with media.

A second validated data spreadsheet (corrected) was submitted to TCEQ on September 15, 2017, with confirmation of data with the highest concentrations done manually, as well as the explanation that all Port Arthur data measurements were all collected on September 9, 2017. Following review of these data, TCEQ again noticed several discrepancies within the dataset and again contacted EDF and Entanglement for clarification on September 19, 2017 (see Appendix A: Time-line of Discrepancies with Validated Data for more detail). Again, Entanglement noted that the GPS coordinates had not sorted correctly.

Entanglement provided a third validated data set (updated corrected), along with the raw data, to TCEQ, noting that the raw data file did not contain the measurement notes and calibration corrections. Review of these data sets (checking the latest validated data document against the raw data) showed there were still several issues with the validated dataset (see Appendix A: Time-line of Discrepancies with Validated Data for more detail). In order to move forward with the evaluation, the decision was made to use the raw data; calibrations corrections and notes were matched to the raw dataset.

Data Quality

The analytical data TCEQ received from EDF and Entanglement did not include a description of the quality processes used for the sampling conducted. To fully understand the quality of the data provided, documented quality assurance/quality control (QA/QC) protocols that ensure the data generated from these field sampling activities are of known and acceptable quality should be described or referenced. Documents detailing sampling procedures, analytical protocols, data management, and data validation are the foundation of reliable environmental sampling and provide the details necessary to understand important limitations of the data. With respect to analytical data, validated data should be accompanied by a report that, at a minimum, summarize data quality objectives identifying the standards for data accuracy, including bias and precision, and targeted data completeness; QA/QC checks performed; and the QA/QC results that were used to ensure these objectives are met. Further, any discussion of data quality should also include a description of any operational or sampling anomalies, such as equipment malfunctions, software malfunctions, or procedural deviations, and whether these impacted data collection, management, or reporting. In the absence of any discussion regarding Entanglement's quality processes for at least the QA/QC of data collection, management, or validation, the TCEQ cannot draw any conclusions as to the quality of the data collected. The TCEQ's evaluation of Entanglement's data should not infer any acceptance or concurrence of the data's quality.

Measurements Collected

According to Entanglement, there were two types of measurements collected: (1) mobile, (2) static. Mobile measurements were collected as the vehicle moved down the street and ranged from a collection duration of 20 – 300 seconds (less than half a minute to 5 minutes), with the majority of samples having a collection duration of 60 or 182 seconds (1 minute and approximately 3 minutes, respectively). A total of 107 mobile measurements were collected over the duration of the sampling days. Static measurements were collected at a single location and ranged from a collection duration of 60 – 300 seconds and some 2400 seconds (1 minute to 5 minutes and 40 minutes, respectively), with the majority of samples having a collection duration of 60 seconds (1 minute). A total of 39 static measurements were collected over the duration of the sampling days. Static measurements in which the duration was 2400 seconds (40 minutes) were referred to in the preliminary dataset as exposure measurements by Entanglement, which they explain as being consistent with the "TCEQ/City of Houston human exposure sampling protocol." A total of three exposure measurements were collected, two on September 7, beginning at approximately 1:28 pm and 7:02 pm, and the third on September 8 at approximately 11:16 am. Two samples were collected in the Manchester neighborhood (9/7/2017 7:02 pm and 9/8/2017 11:16 am). The third sample was collected in the Deer Park area (9/7/2017 1:28 pm).

It appears that approximately 13 samples were collected in the Port Arthur area, with the remaining 133 samples collected in the Houston area.

Maximum (Max) measurement values for mobile and static sampling are presented in Table 1. Max measurements were measured in the Houston area, specifically in the Manchester neighborhood near the damaged Valero tank.

Table 1. Max Values Measured during Mobile and Static Monitoring.

Measurement Type	Duration (sec)	Benzene Max Value (ppb)	Toluene Max Value (ppb)	Ethylbenzene Max Value (ppb)	Xylenes Max Value (ppb)
Mobile ¹	60	91.11	193.20	20.84	112.98
Static ²	60	185.92	481.12	23.47	173.97

¹ Max values are from 9/6/2017 beginning at 13:23:25 (approximately 1,600 feet southwest of the damaged Valero tank, which is downwind based on provided wind direction)

² Max values are from 9/4/2017 beginning at 17:31:52 (approximately 775 feet northwest of the damaged Valero tank, which is downwind based on provided wind direction)

Evaluation of Data

TCEQ Air Monitoring Comparison Values (AMCVs)

The TCEQ 1-hour Air Monitoring Comparison Values (AMCVs) for the four sampled compounds are presented in Table 2. AMCVs are chemical-specific screening levels for ambient air set to protect human health and welfare. Health-based AMCVs are safe levels at which exposure of similar duration is not expected to result in adverse health effects. AMCVs are used to determine if there is a potential concern. They are set at levels sufficiently below a level expected to cause adverse health effects so that, even when concentrations of a contaminant are somewhat above the AMCV, adverse health effects are not expected.

Table 2. TCEQ 1-Hour Health-based AMCVs.

Health-Based AIVICV (DDD	th-Based AMCV (ppb	b)	aa	<i>'</i> (CV	M	Α	ed	as	-B	th	eal	Н
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Benzene	180
Toluene	4,000
Ethylbenzene	20,000
Xylenes	1,700

Data Usefulness

There are typically two types of ambient air data collected: (1) grab samples and (2) time-integrated samples. Grab samples provide data that are used for source identification. The short nature of the sample (generally with a duration measured in seconds), in conjunction with meteorological data, aids in the identification of potential sources of a contaminant plume. An example of this would be the EPA's use of their Trace Atmospheric Gas Analyzer (TAGA) bus. TAGA is a self-contained mobile laboratory capable of real-time sampling of outdoor air emissions while in motion, very much like the Entanglement vehicle. Use of the TAGA data, along with investigator hand-held response equipment, aided in the conclusion by EPA that the probable source of elevated benzene and VOC readings in the Manchester community was the roof failure and spill at that Valero facility.

Time-integrated samples provide data that can be used not only for source identification, but also for health effects evaluations. This method allows for a sample to be collected over a longer period of time (generally with a duration of 30 minutes or greater). A longer sample duration provides data that are sufficiently similar to the durations used to derive safe levels, such as AMCVs, for comparison.

The bulk of the data collected during this sampling effort falls into the grab sample category (143 of 146 samples collected). Like TAGA data, these samples are useful for attempting to

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identify any potential sources of pollutants, but cannot reliably be used in human health assessment.

There were three samples collected that fall into the category of time-integrated samples, which can be evaluated from a human health perspective. The max 40-minute value of benzene for those samples is 0.88 ppb (see Table 3), which is approximately 204 times lower than the 1-hour health-based benzene AMCV of 180 ppb. Based on these data, we would not expect adverse effects to occur as a result of exposure to these concentrations.

Table 3. Benzene Time-Integrated Measurements.

Sample Date	9/7/2017	9/7/2017	9/8/2017
Sample Time	13:28:14	19:02:02	11:16:15
Benzene (ppb)	0.26	0.62	0.88

Exceedances Do Not Equal Health Effects

As discussed above, health-based AMCVs are set to provide a margin of safety and are set well below levels at which adverse health effects are reported in the scientific literature. So, an exceedance of an AMCV by a sample of similar duration does not constitute a bright line where health effects would occur. Rather, an exceedance tells us that we need to look further and conduct a more in-depth review (e.g., location of population, potential for exposure, and frequency and magnitude of detections and how do they compare to levels at which health effects would be anticipated?).

In the case of benzene, the TCEQ short-term AMCV is set to protect against adverse blood changes, which was the most sensitive critical effect observed in the scientific literature. Effects associated with this critical effect were observed at concentrations of 10,200 ppb benzene in mice exposed for 6 hours a day over the course of 6 days. Adjusting just one of the 6-hour exposures to a 1-hour exposure results in a human equivalent concentration of 18,500 ppb. To put this into perspective, the health-based 1-hour AMCV for benzene is approximately 103 times lower than this level. In the context of hurricane damage, it is also noted that the 1-hour AMCV is approximately 290 times lower than the EPA 1-hour Acute Exposure Guideline Level (AEGL) of 52,000 ppb for emergency situations.

In another example to help put acute benzene exposure into perspective, in January of 2010, the TCEQ conducted a gasoline VOC study in an effort to characterize VOC emissions from gasoline during vehicle refueling. Instantaneous (i.e., grab) measurements from that study showed benzene concentrations as high as 11,000 ppb at the fuel tank and 250 ppb five feet downwind, when a vapor recovery system (VRS) is not in place. Most newer-model vehicles are equipped with a VRS, but any time an individual interacts with gasoline (e.g., filling a lawn mower, etc.), they are potentially, acutely, exposed to relatively high levels of benzene. We are

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all exposed to varying levels of chemicals throughout the day, some relatively higher and some lower. Acute, transient, exposures to elevated levels are not of a health concern, as long as they are not of sufficient duration and magnitude to produce adverse health effects.

Conclusions

While the majority of the data are of the grab sample category and cannot be used for human health assessment, they do provide vital data to aid in source identification. Source identification aids in the rapid response to fix any potential issues. Concentrations from the three time-integrated samples, which can be used for human health evaluation, were all well below their respective health-based AMCVs. Based on these data, we would not expect adverse effects to occur as a result of exposure to these concentrations.

Appendix A: Time-line of Discrepancies with Validated Data

First Validated Data Set

TCEQ requested the final dataset from EDF on September 14, 2017 and EDF shared the validated data that day. That afternoon, the Texas Tribune and ProPublica published a joint news article citing the Entanglement data collected in the Manchester and Port Arthur areas. TCEQ reviewed the provided data, and noted several discrepancies.

Discrepancies noted in the Validated Data file

1. Port Arthur samples associated with data from days/times that aren't feasible given the other sampling and coordinates (i.e., travel time from Houston to Port Arthur preclude these samples from being collected within minutes of each other).

	Time					
Date	[cdt]	mean_lat	mean_long	Issue		
9/4/2017	9:17:47	29.826849	-93.9654656	Coordinates are in Port Arthur, but sample		
				should be from Houston area		
9/4/2017	9:32:24	29.8267822	-93.9654704	Coordinates are in Port Arthur, but sample		
				should be from Houston area		
9/6/2017	12:59:17	29.8723124	-93.97152	Coordinates are in Port Arthur, but sample		
				should be from Houston area		
9/6/2017	13:38:43	29.8548604	-93.9702668	Coordinates are in Port Arthur, but sample		
				should be from Houston area		
9/7/2017	16:50:44	29.9546557	-93.8939312	Coordinates are in Port Arthur, but sample		
			should be from Houston area			
9/8/2017	7 9:45:24 29.8829626 -93.9371134		-93.9371134	Coordinates are in Port Arthur, but sample		
				should be from Houston area		
9/8/2017	12:11:49	29.8799136	-93.9365868	Coordinates are in Port Arthur, but sample		
				should be from Houston area		
9/8/2017	12:27:41	29.8741956	-93.9519121	Coordinates are in Port Arthur, but sample		
				should be from Houston area		
9/8/2017	14:00:33	29.8864744	-93.9416028	Coordinates are in Port Arthur, but sample		
				should be from Houston area		
9/8/2017	19:26:16	29.833241	-93.968295	Coordinates are in Port Arthur, but sample		
				should be from Houston area		
9/8/2017	19:44:52	29.9650875	-93.9482523	Coordinates are in Port Arthur, but sample		
				should be from Houston area		

2. Values listed in Texas Tribune/ProPublica article do not match values in the validated data file given to TCEQ.

Date	Time [cdt]	Validated Data File Benzene (ppb)	News Article Benzene (ppb)	Issue
9/4/20174	8:45:30	10.9	90	At the location indicated in the news article, the validated data file indicates the value is 10.9, not 90.
9/4/2017	10:56:10	53	52	The validated data file indicates the second highest benzene concentration measured in the area indicated on the first map in the news article is 53, not 52.
9/4/2017	17:31:52	186	77	The validated data file indicates the highest benzene concentration measured in the area indicated on the first map in the news article is 186, not 77.
9/9/2017	11:43:01		77	The only benzene concentration of 77 in the validated data file indicates the location is approximately 2,300 feet west of 610.
9/8/2017	14:00:33	5.2	76	The highest benzene concentration measured in Port Arthur, according to the validated data file, is 5, not 76.

Clarification Requested

TCEQ contacted EDF for clarification of the noted discrepancies on September 15, 2017. EDF set up a conference call between EDF, Entanglement, and TCEQ to discuss the issues. After explaining the observed discrepancies, Entanglement noted that latitude/longitude coordinates were in fact incorrect in the validated data file sent to TCEQ. It appears that may have been a sorting error that disassociated the correct coordinates with the appropriate data. It was also noted by Entanglement that the validated data file sent to TCEQ did not match the file shared with the media prior to TCEQ.

Second Validated Data Set (Updated)

Following the discussion between EDF, Entanglement, and TCEQ, Entanglement provided TCEQ with a corrected validated data file on September 15, 2017. Entanglement noted that they had manually confirmed data and coordinates with the highest concentrations. They also stated that all data measurements collected on September 9, 2017 were from the Port Arthur area. Following review of these data, TCEQ again noticed several discrepancies within the dataset.

Discrepancies noted in the Validated Data file (updated)

1. Port Arthur Samples, again, do not appear correct.

	Time		_	
Date	[cdt]	mean_lat	mean_long	Issue
9/4/2017	14:54:43	29.85486	-93.970267	Coordinates are in Port Arthur, but sample should be from Houston area
9/5/2017	15:20:14	29.872312	-93.97152	Coordinates are in Port Arthur, but sample should be from Houston area
9/6/2017	11:16:56	29.886474	-93.941603	Coordinates are in Port Arthur, but sample should be from Houston area
9/6/2017	18:00:37	29.965088	-93.948252	Coordinates are in Port Arthur, but sample should be from Houston area
9/7/2017	12:24:32	29.874196	-93.951912	Coordinates are in Port Arthur, but sample should be from Houston area
9/9/2017	10:33:24	29.715108	-95.255821	Coordinates are in Manchester area, but sample should be from Port Arthur
9/9/2017	10:53:24	29.722018	-95.278875	Coordinates are in Houston area (<1 mile west of Manchester neighborhood), but sample should be from Port Arthur
9/9/2017	11:27:03	29.690783	-95.256992	Coordinates are in Houston area ~1.6 miles south of Manchester neighborhood), but sample should be from Port Arthur
9/9/2017	11:57:16	29.721923	-95.279803	Coordinates are in Houston area (<1 mile west of Manchester neighborhood), but sample should be from Port Arthur
9/9/2017	13:29:25	29.64869	-95.154091	Coordinates are in Houston area (Pasadena area), but sample should be from Port Arthur

2. Some mobile samples appear to be mismatched with lat/longs that are indicative of a static sample.

Date	Time [cdt]	Туре	Latitude Track	Longitude Track	Issue
9/4/2017	8:23:52	mobile	No	No	No lat/long track, only a single lat/long coordinate, which would indicate a static sample
9/4/2017	13:51:14	mobile	No	No	No lat/long track, only a single lat/long coordinate, which would indicate a static sample
9/5/2017	11:53:05	mobile	No	No	No lat/long track, only a single lat/long coordinate, which would indicate a static sample
9/7/2017	11:14:39	mobile	No	No	No lat/long track, only a single lat/long coordinate, which would indicate a static sample

9/7/2017	18:21:44	mobile	No	No	No lat/long track, only a single lat/long coordinate, which would indicate a static sample
9/8/2017	14:47:44	mobile	No	No	No lat/long track, only a single lat/long coordinate, which would indicate a static sample
9/9/2017	10:33:24	mobile	No	No	No lat/long track, only a single lat/long coordinate, which would indicate a static sample
9/9/2017	13:29:25	mobile	No	No	No lat/long track, only a single lat/long coordinate, which would indicate a static sample

3. Some static samples appear to be mismatched with lat/longs that are indicative of a mobile sample.

Date	Time [cdt]	Туре	Latitude Track	Longitude Track	Issue
9/4/2017	11:26:59	static	Yes	Yes	Lat/longs listed in track, which would indicate a mobile sample
9/5/2017	15:39:15	static	Yes	Yes	Lat/longs listed in track, which would indicate a mobile sample
9/7/2017	12:24:32	static	Yes	Yes	Lat/longs listed in track, which would indicate a mobile sample
9/7/2017	13:28:14	static	Yes	Yes	Lat/longs listed in track, which would indicate a mobile sample
9/7/2017	16:50:44	static	Yes	Yes	Lat/longs listed in track, which would indicate a mobile sample
9/7/2017	19:02:02	static	Yes	Yes	Lat/longs listed in track, which would indicate a mobile sample
9/8/2017	11:16:15	static	Yes	Yes	Lat/longs listed in track, which would indicate a mobile sample
9/8/2017	17:32:51	static	Yes	Yes	Lat/longs listed in track, which would indicate a mobile sample

Clarification Requested

TCEQ contacted EDF and Entanglement for clarification of the noted discrepancies on September 19, 2017. Entanglement again reviewed the noted discrepancies and agreed that the latitude/longitude coordinates were again incorrect in the corrected validated data file sent to TCEQ. Again, it appears that may have been a sorting error that disassociated the correct coordinates with the appropriate data.

Third Validated Data Set (Updated Corrected)

Entanglement provided a third validated data set (updated corrected), along with the raw data, to TCEQ and thanked the TCEQ for catching the problems with the validated data file. Entanglement noted that the raw data file did not contain the measurement notes and calibration corrections. Review of these two data sets (checking the latest validated data document against the raw data) showed there were still several issues with the new validated dataset.

Differences between Validated Data file (updated corrected) and Raw Data file

1. The columns mean_latitude and mean_longitude appear to be flipped for 9/7/2017 12:24:32 and 9/7/2017 13:28:14.

		RAW DATA		VALIDATED D	ATA
date	time [cdt]	mean_lat	mean_long	mean_lat	mean_long
9/7/2017	13:28:14	29.6700981	-95.1284994	29.6486896	-95.1540907
9/7/2017	12:24:32	29.6486896	-95.1540907	29.6700981	-95.1284994

2. The columns wind dirn and wind speed associated with 9/7/2017 12:24:32 and 9/7/2017 13:28:14 are different between the raw and validated data (see #4 below for all wind dirn/wind speed issues).

			RAW DATA	l	VALIDATE	DATA
date	time	collec	wind dirn wind speed wind dirn w		wind speed	
	[cdt]	durat [s]				
9/7/2017	13:28:14	2400	25	3	10	5
9/7/2017	12:24:32	240	22	4	24	5

The column longitude_track appears to be cutting off values at the decimal in the 22nd longitude value in the string of values for a mobile sample. This affects 84 of 107 samples.

		RAW DATA	l	VALIDATE	DATA
date	time [cdt]	# long in	last long	# long in	last long
		long_track	listed	long_track	listed
9/4/2017	8:23:52	22	-95	36	-95.2808752
9/4/2017	8:45:30	22	-95	36	-95.2526115
9/4/2017	9:02:23	22	-95	36	-95.2258435
9/4/2017	9:17:47	22	-95	36	-95.2276077
9/4/2017	9:32:24	22	-95	36	-95.260139
9/4/2017	10:03:07	22	-95	36	-95.265733
9/4/2017	10:25:43	22	-95	36	-95.2627772
9/4/2017	10:40:45	22	-95	36	-95.2559835

9/4/2017	10:56:10	22	-95	36	-95.2570973
9/4/2017	11:10:44	22	-95	36	-95.2559018
9/4/2017	11:57:34	22	-95	36	-95.2543118
9/4/2017	13:33:30	22	-95	35	-95.2531787
9/4/2017	13:51:14	22	-95	35	-95.2801525
9/4/2017	14:06:37	22	-95	35	-95.266059
9/4/2017	14:21:29	22	-95	35	-95.2575798
9/4/2017	14:39:46	22	-95	35	-95.2669372
9/4/2017	14:54:43	22	-95	36	-95.245337
9/4/2017	15:29:28	22	-95	36	-95.2643497
9/5/2017	11:06:52	22	-95	24	-95.2578097
9/5/2017	11:20:19	22	-95	24	-95.2667307
9/5/2017	11:35:09	22	-95	47	-95.2486435
9/5/2017	11:53:05	22	-95	47	-95.2757462
9/5/2017	12:08:42	22	-95	48	-95.2579582
9/5/2017	12:24:35	22	-95	47	-95.2503587
9/5/2017	12:49:48	22	-95	47	-95.222589
9/5/2017	13:06:12	22	-95	47	-95.2033667
9/5/2017	14:16:11	22	-95	48	-95.2538728
9/5/2017	14:32:10	22	-95	48	-95.2668097
9/5/2017	14:48:02	22	-95	47	-95.24616
9/5/2017	15:04:05	22	-95	48	-95.2502863
9/5/2017	15:20:14	22	-95	47	-95.2695632
9/5/2017	16:31:06	22	-95	47	-95.255939
9/6/2017	10:13:20	22	-95	47	-95.0134438
9/6/2017	10:34:44	22	-95	47	-95.0121753
9/6/2017	11:16:56	22	-95	46	-95.0069305
9/6/2017	11:36:54	22	-95	48	-95.0302995
9/6/2017	12:00:50	22	-95	47	-95.0098135
9/6/2017	12:19:32	22	-95	47	-94.9933612
9/6/2017	14:13:37	22	-95	46	-95.374407
9/6/2017	14:29:11	22	-95	47	-95.6029183
9/6/2017	14:44:46	22	-95	47	-95.7356523
9/6/2017	15:09:47	22	-95	47	-95.7314875
9/6/2017	15:45:10	22	-95	23	-95.72895
9/6/2017	16:18:19	22	-95	48	-95.7389048
9/6/2017	16:58:57	22	-95	36	-95.7355045
9/6/2017	17:17:01	22	-95	36	-95.5635475
9/6/2017	17:31:32	22	-95	36	-95.4973317
9/6/2017	17:46:05	22	-95	36	-95.4230013
9/6/2017	18:00:37	22	-95	36	-95.4084955
9/6/2017	18:15:58	22	-95	36	-95.4327143
9/6/2017	18:31:25	22	-95	35	-95.4442525
9/7/2017	9:50:24	22	-95	36	-95.3852028

9/7/2017	10:04:54	22	-95	36	-95.2824548
9/7/2017	10:35:40	22	-95	24	-95.260437
9/7/2017	10:50:32	22	-95	59	-95.217865
9/7/2017	11:14:39	22	-95	59	-95.2647548
9/7/2017	11:49:28	22	-95	47	-95.1481283
9/7/2017	14:56:16	22	-95	35	-95.2536243
9/7/2017	15:10:59	22	-95	36	-95.2587042
9/7/2017	16:16:05	22	-95	36	-95.2542853
9/7/2017	17:49:59	22	-95	35	-95.1530573
9/7/2017	18:05:15	22	-95	47	-95.211703
9/7/2017	18:21:44	22	-95	24	-95.2198323
9/7/2017	18:35:29	22	-95	23	-95.2016788
9/8/2017	16:02:32	22	-95	59	-95.2580758
9/8/2017	16:27:43	22	-95	24	-95.2715478
9/8/2017	19:07:27	22	-95	58	-95.4421192
9/8/2017	19:26:16	22	-95	58	-95.4820338
9/8/2017	19:44:52	22	-95	58	-95.4979272
9/8/2017	20:02:09	22	-95	57	-95.4829095
9/8/2017	20:37:06	22	-95	58	-95.4540633
9/8/2017	20:59:37	22	-95	46	-95.4404355
9/8/2017	21:15:18	22	-95	24	-95.434363
9/8/2017	21:47:00	22	-95	35	-95.2559443
9/9/2017	10:33:24	22	-95	46	-93.9424513
9/9/2017	10:53:24	22	-95	23	-93.9637235
9/9/2017	11:09:03	22	-95	46	-93.943659
9/9/2017	11:27:03	22	-95	47	-93.971879
9/9/2017	12:31:20	22	-95	47	-93.9387483
9/9/2017	13:29:25	22	-95	47	-93.9429823
9/9/2017	13:46:43	22	-95	24	-93.9024518
9/9/2017	14:02:17	22	-95	47	-93.949589
9/9/2017	14:24:30	22	-95	35	-93.9898563
9/9/2017	14:40:58	22	-95	35	-94.0066075

4. In a continuation of #2 above, the columns wind dirn and wind speed do not match for 42 and 31 samples, respectively.

		RAW E	DATA	VALIDATED DATA		
date	time	wind	wind	wind	wind	
	[cdt]	dirn	speed	dirn	speed	
9/4/2017	8:23:52	23	2	76	2	
9/4/2017	11:26:59	76	2	29	3	
9/4/2017	13:33:30	119	3	16	6	
9/4/2017	13:51:14	119	3	29	3	

9/4/2017	14:54:43	106	3	24	5
9/5/2017	11:20:19	359	2	15	7
9/5/2017	11:35:09	4	2	356	2
9/5/2017	11:53:05	4	2	25	3
9/5/2017	12:49:48	356	2	35	4
9/5/2017	15:20:14	45	2	24	5
9/5/2017	15:39:15	30	2	106	3
9/5/2017	16:31:06	63	2	72	2
9/6/2017	11:16:56	19	7	19	5
9/6/2017	11:36:54	11	6	6	8
9/6/2017	12:00:50	11	6	19	7
9/6/2017	12:59:17	7	8	29	3
9/6/2017	14:29:11	6	8	359	2
9/6/2017	15:45:10	15	7	11	6
9/6/2017	17:17:01	16	6	11	6
9/6/2017	17:31:32	10	5	11	2
9/6/2017	18:00:37	10	5	18	5
9/7/2017	10:50:32	35	4	10	5
9/7/2017	11:14:39	35	4	61	3
9/7/2017	13:28:14	25	3	24	5
9/7/2017	12:24:32	22	4	10	5
9/7/2017	14:41:10	40	4	7	8
9/7/2017	16:50:44	40	3	4	2
9/7/2017	18:21:44	38	3	30	2
9/7/2017	18:35:29	36	2	4	2
9/8/2017	11:16:15	61	3	38	3
9/8/2017	14:47:44	72	2	36	2
9/8/2017	15:48:00	41	2	40	3
9/8/2017	16:27:43	41	2	63	2
9/8/2017	17:32:51	29	3	119	3
9/8/2017	17:45:19	29	3	35	4
9/8/2017	17:57:47	29	3	41	2
9/8/2017	21:47:00	11	2	40	4
9/9/2017	10:33:24	24	5	41	2
9/9/2017	10:53:24	24	5	23	2
9/9/2017	11:27:03	24	5	45	2
9/9/2017	11:57:16	22	5	119	3
9/9/2017	13:29:25	19	5	22	4
9/9/2017	14:02:17	18	5	22	5

Solution

After receiving and promptly checking the accuracy of the third validated file, along with the raw data file, September 19, 2017, and the above differences were noted, TCEQ made the decision to utilize the raw data file for evaluation. TCEQ matched the validated analytical calibration corrections and notes to the appropriate data set (to account for QA/QC changes to the data). After merging, checks were done between the raw data file and the validated data file to ensure correct pairing of the calibration corrections and notes to the data. The end result is a file that has the correct analytical calibration corrections and notes matched with the correct date/time/wind direction/wind speed/latitude/longitude data in the raw data file.

TCEQ then matched the longitude_track points to the appropriate data set (to allow for accurate mapping of mobile samples since some mobile samples have up to 59 coordinates). There are 107 mobile samples and each sample is paired with unique GPS coordinates. After merging the longitude track coordinates with the raw data file, a check was done to make sure the first and 21st longitude track points matched, to ensure correct pairing of coordinates to data.

TCEQ mapped the data in ArcMap to confirm all samples collected on 9/9/2017 were now mapping to the Port Arthur area, which was a benchmark for proper data-coordinate alignment previously. Inspection of the data in the spreadsheet also showed all static measurements were now associated only with one latitude/longitude coordinate and all mobile measurements were now associated with a latitude/longitude track, which was another benchmark for proper data-coordinate alignment.

Based on these two benchmarks, TCEQ's usage of the raw data file, along with proper merging of the validated analytical calibrations corrections, notes, and longitude tracks, appears to have solved the issues observed in all three submitted validated data files.

Appendix B: Maps of Sampling Locations – Manchester Area

BENZENE (ppb)



Protecting Texas by Reducing and Preventing Pollution

Texas Commission on Environmental Quality GIS Team (Mail Code 197) P.O. Box 13087 Austin, Texas 78711-3087

Date: 9/27/2017

Static Sampling Events

BenzenePPB

- 78.29 185.92
- 0 20.00 78.28
- 7.22 19.99
- 1.11 7.21
- 0.63 1.10
- 0.29 0.62
- 0 0.28

Mobile Sampling Events

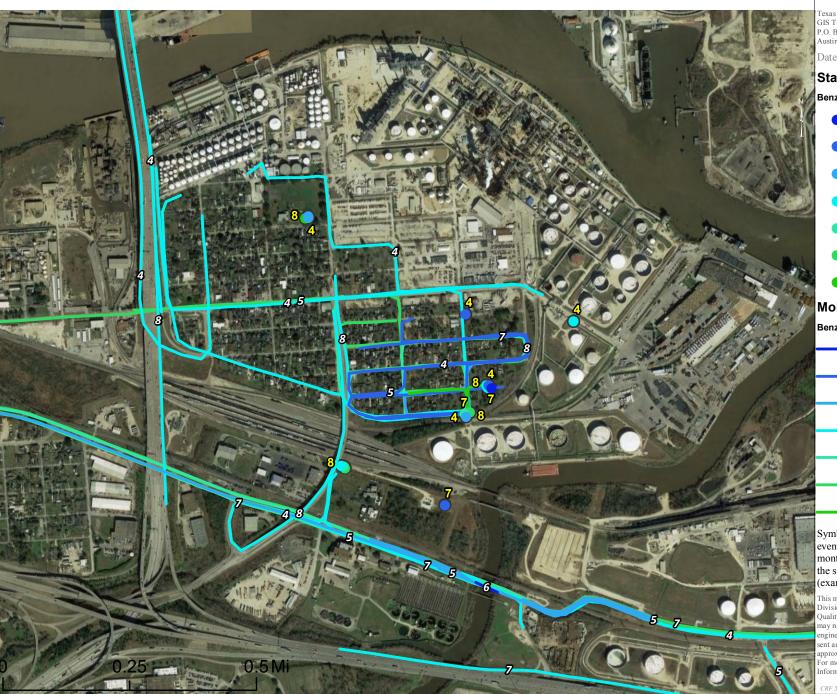
BenzenePPB

- **78.29 185.92**
 - 20.00 78.28
 - **7**.22 19.99
 - 1.11 7.21
 - 0.63 1.10
 - 0.29 0.62
 - **0** 0.28

Symbol Notes: The number label on event features refers to the day of the month in September of 2017 on which the sampling event occurred. (example: 9/7/2017 = 7)

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CRF 511047RequestD20170922_BENZENE_Manchester



ETHYLBENZENE (ppb)



Protecting Texas by Reducing and Preventing Pollution

Texas Commission on Environmental Quality GIS Team (Mail Code 197) P.O. Box 13087 Austin, Texas 78711-3087

Date: 9/27/2017

Static Sampling Events

EthylbenzenePPB

- 11.73 23.47
- 3.81 11.72
- 2.42 3.80
- 0.93 2.41
- 0.32 0.92
- 0.21 0.31
- 0 0.20

Mobile Sampling Events

EthylbenzenePPB

11.73 - 23.47

3.81 - 11.72

2.42 - 3.80

0.93 - 2.41

0.32 - 0.92

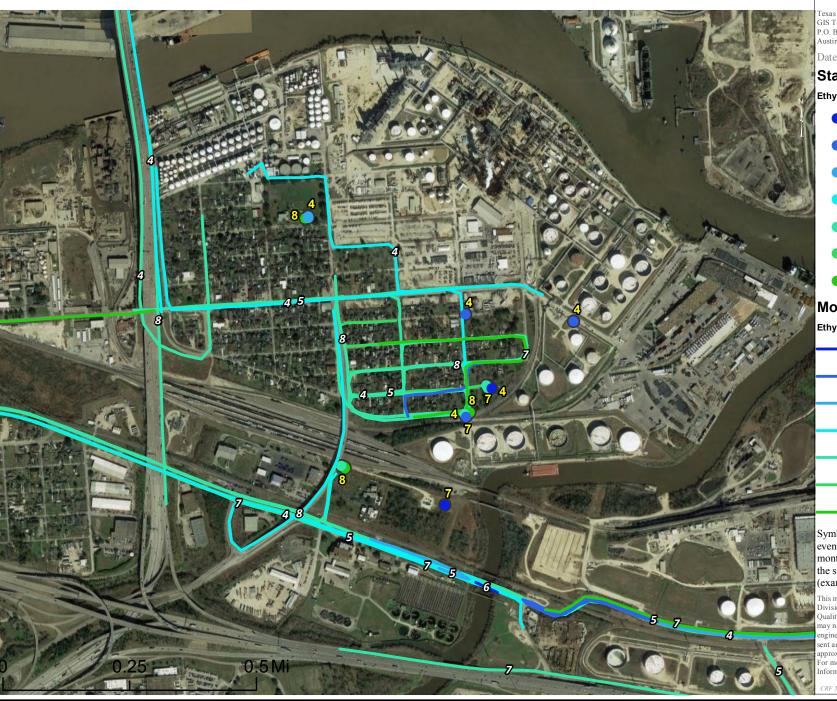
0.21 - 0.31

0 - 0.20

Symbol Notes: The number label on event features refers to the day of the month in September of 2017 on which the sampling event occurred. (example: 9/7/2017 = 7)

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CRF 511047RequestD20170922_ETHYLBENZENE_Manchester







Protecting Texas by Reducing and Preventing Pollution

Texas Commission on Environmental Quality GIS Team (Mail Code 197) P.O. Box 13087 Austin, Texas 78711-3087

Date: 9/27/2017

Static Sampling Events

ToluenePPB

- 177.74 481.12
- 94.29 177.73
- 26.54 94.28
- 13.34 26.53
- 4.33 13.33
- 1.14 4.32
- 0 1.13

Mobile Sampling Events

ToluenePPB

177.74 - 481.12

94.29 - 177.73

26.54 - 94.28

13.34 - 26.53

4.33 - 13.33

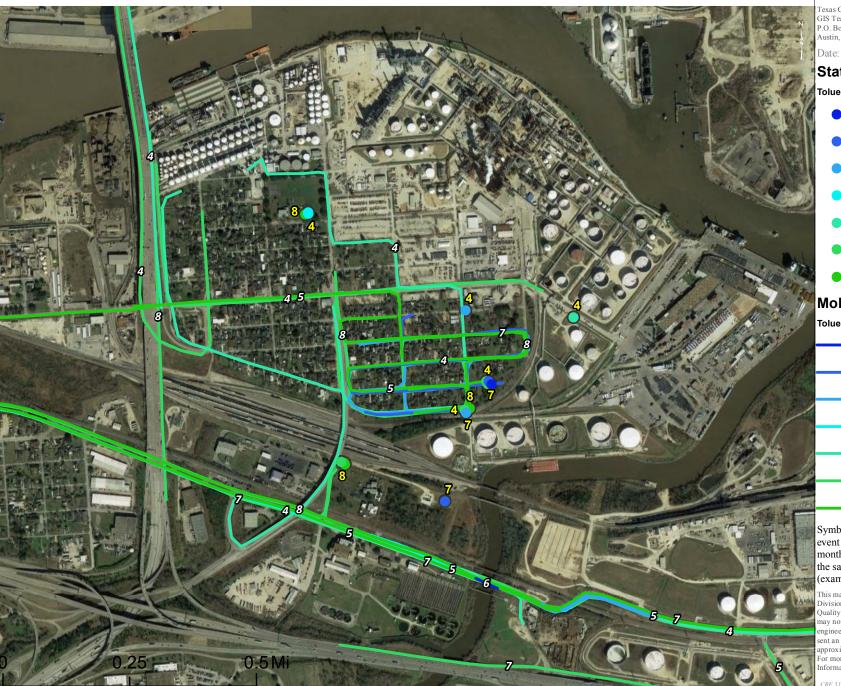
1.14 - 4.32

0 - 1.13

Symbol Notes: The number label on event features refers to the day of the month in September of 2017 on which the sampling event occurred. (example: 9/7/2017 = 7)

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CRF 511047RequestD20170922_TOLUENE_Manchester



XYLENES (ppb)



Protecting Texas by Reducing and Preventing Pollution

Texas Commission on Environmental Quality GIS Team (Mail Code 197) P.O. Box 13087 Austin, Texas 78711-3087

Date: 9/27/2017

Static Sampling Events

XylenesPPB

- 9 59.94 173.97
- 21.30 59.93
- 12.73 21.29
- 5.50 12.72
- 1.73 5.49
- 1.03 1.72
- 0 1.02

Mobile Sampling Events

XylenesPPB

59.94 - 173.97

21.30 - 59.93

12.73 - 21.29

5.50 - 12.72

1.73 - 5.49

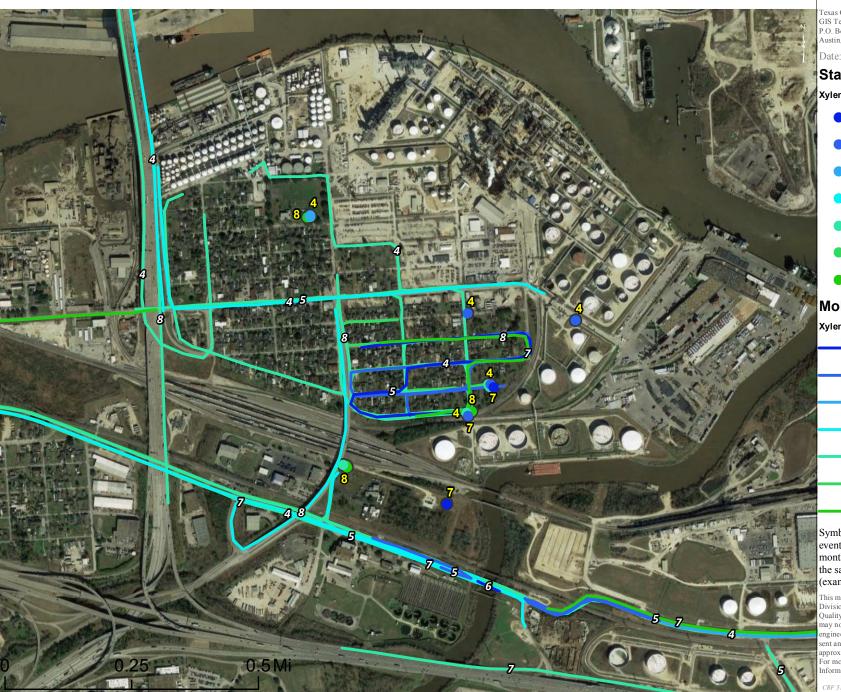
1.03 - 1.72

0 - 1.02

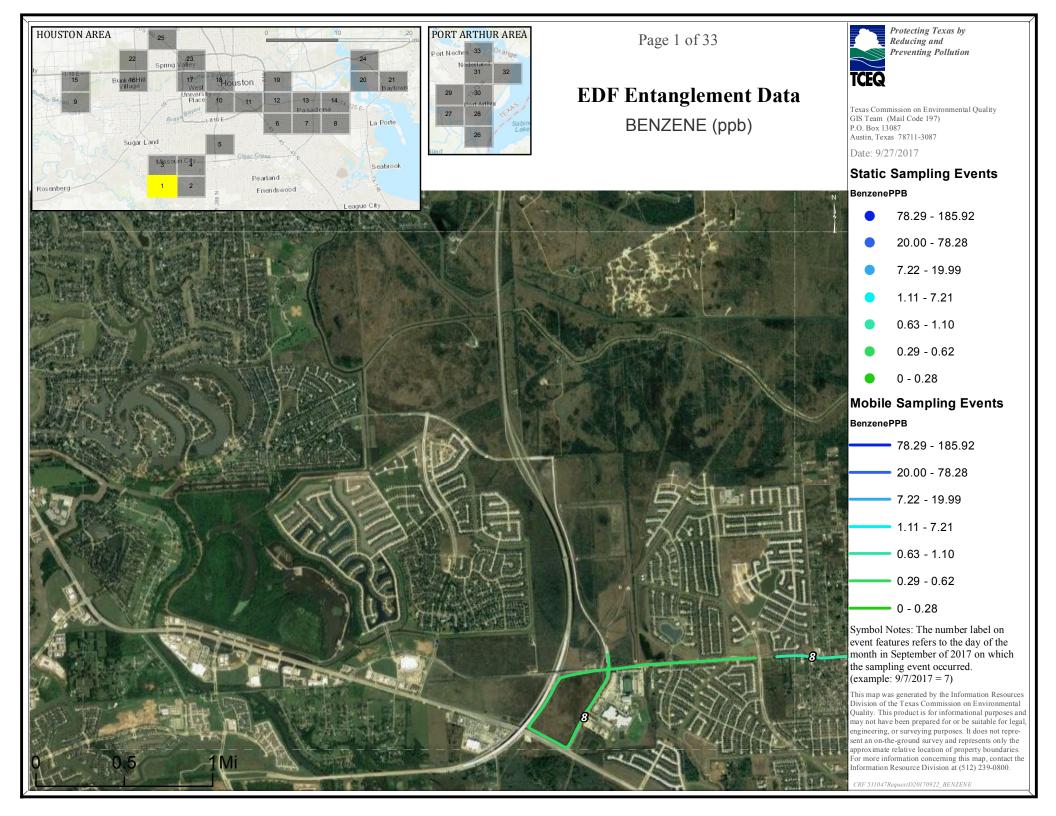
Symbol Notes: The number label on event features refers to the day of the month in September of 2017 on which the sampling event occurred. (example: 9/7/2017 = 7)

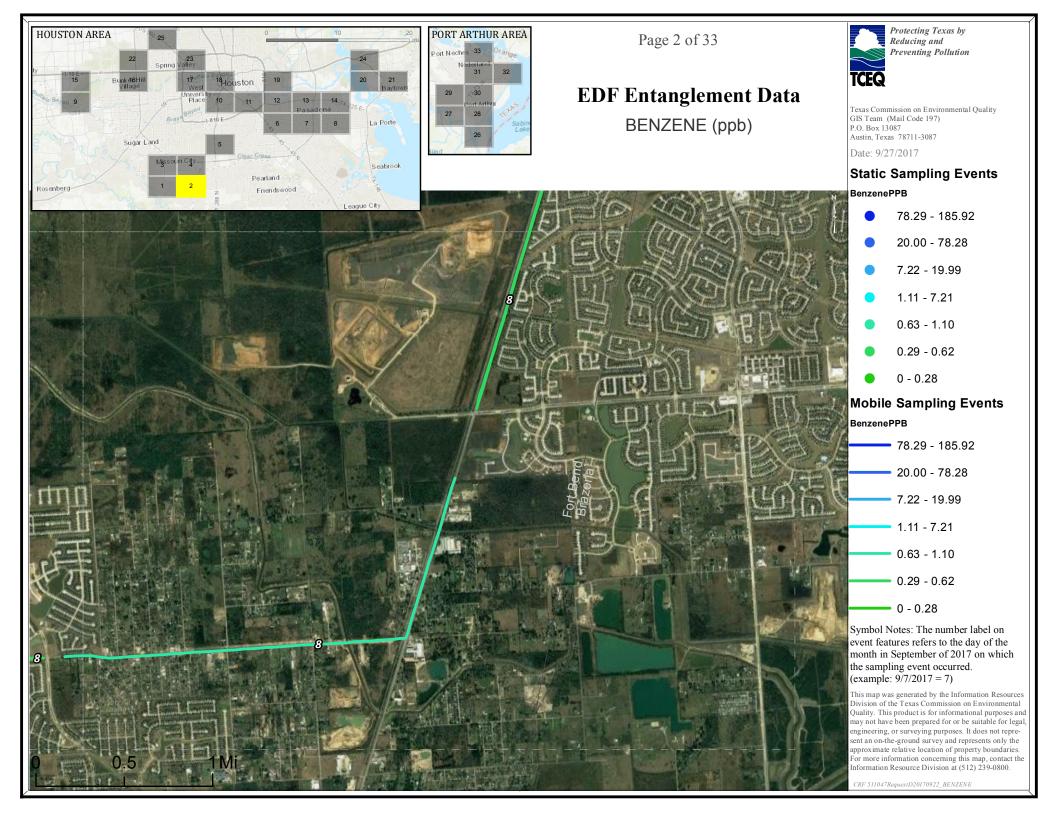
This map was generated by the Information Resources Division of the Texas Commission on Environmental Quality. This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. It does not represent an on-the-ground survey and represents only the approximate relative location of property boundaries. For more information concerning this map, contact the Information Resource Division at (512) 239-0800.

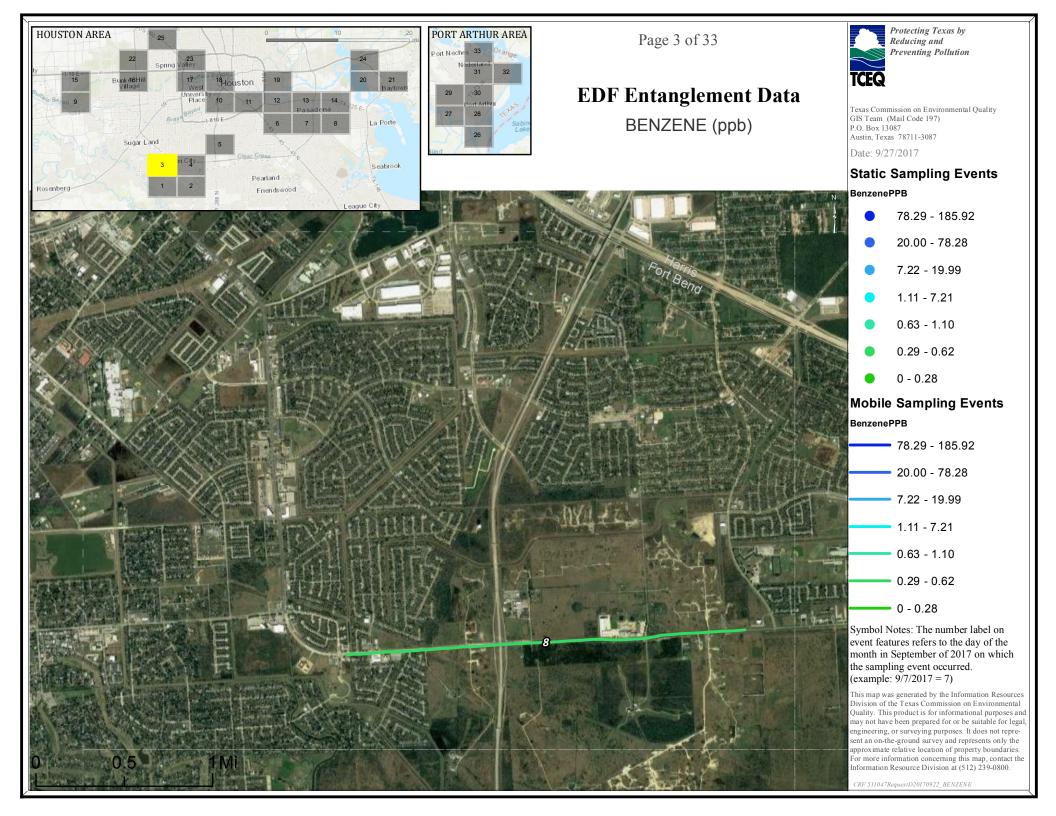
CRF 511047RequestD20170922_XYLENE_Manchester

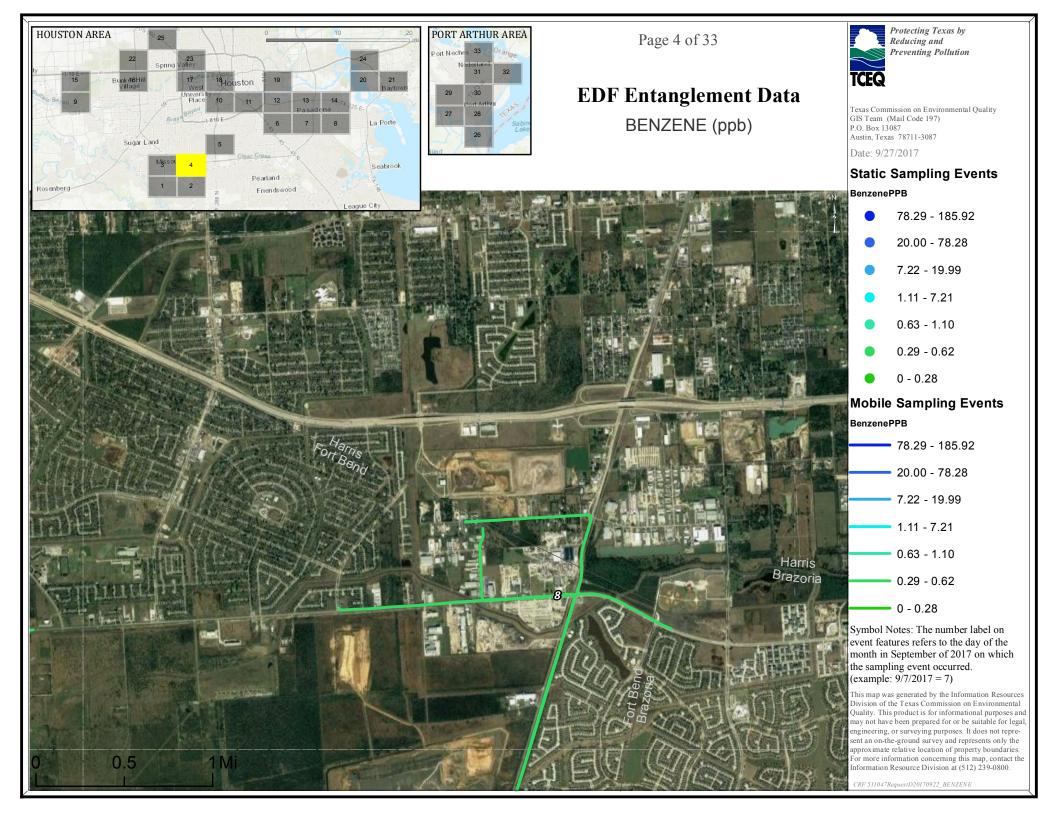


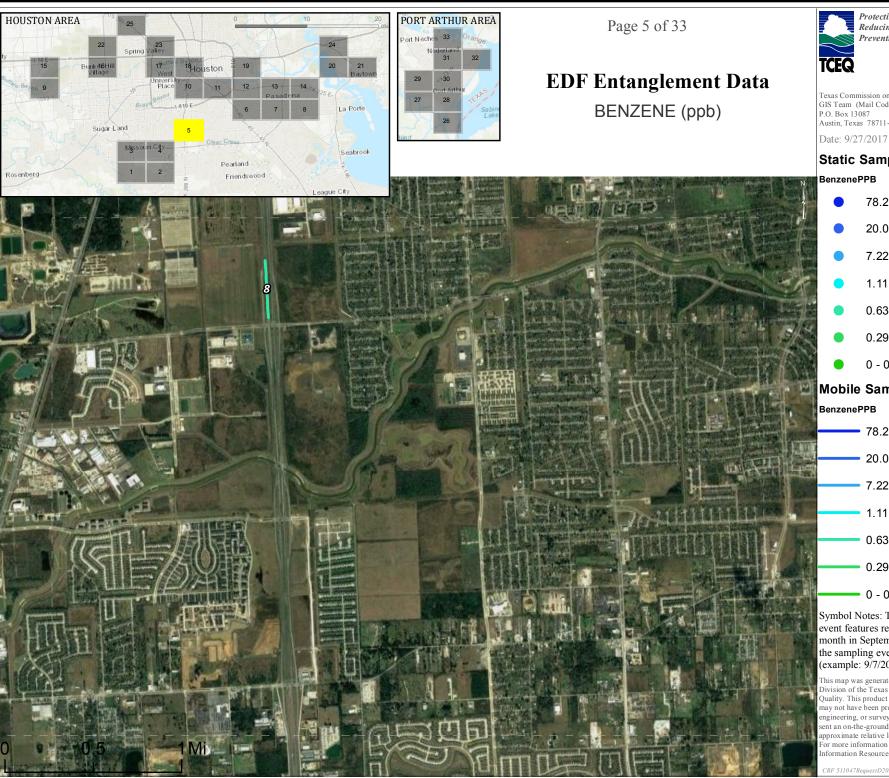
Appendix C: Maps of Sampling Locations – All Areas











Protecting Texas by Reducing and Preventing Pollution

Texas Commission on Environmental Quality GIS Team (Mail Code 197) Austin, Texas 78711-3087

Static Sampling Events

- 78.29 185.92
- 20.00 78.28
- 7.22 19.99
- 1.11 7.21
- 0.63 1.10
- 0.29 0.62
- 0 0.28

Mobile Sampling Events

78.29 - 185.92

20.00 - 78.28

7.22 - 19.99

1.11 - 7.21

0.63 - 1.10

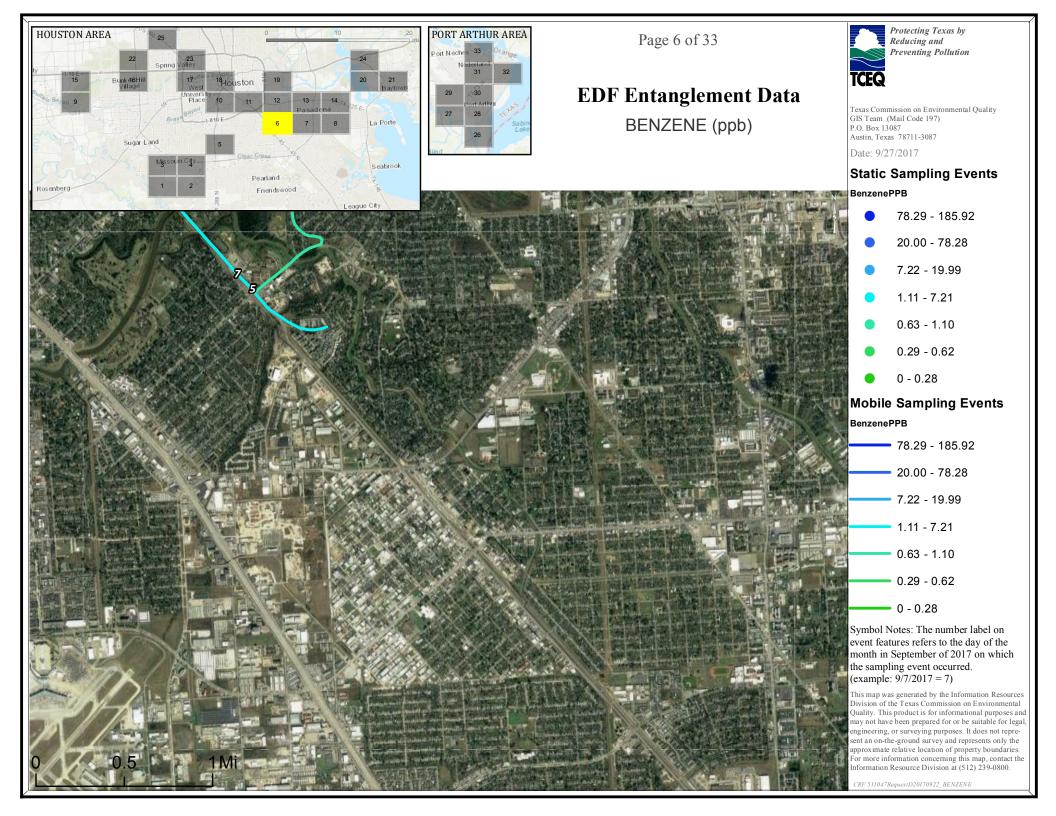
0.29 - 0.62

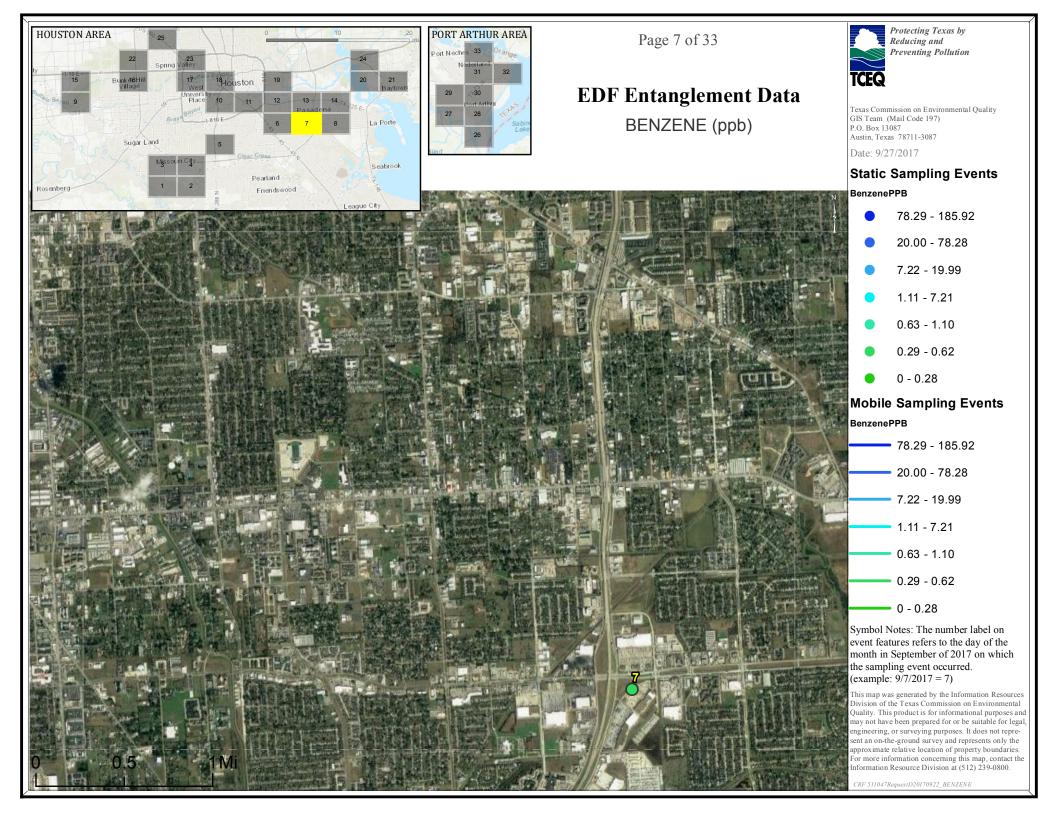
0 - 0.28

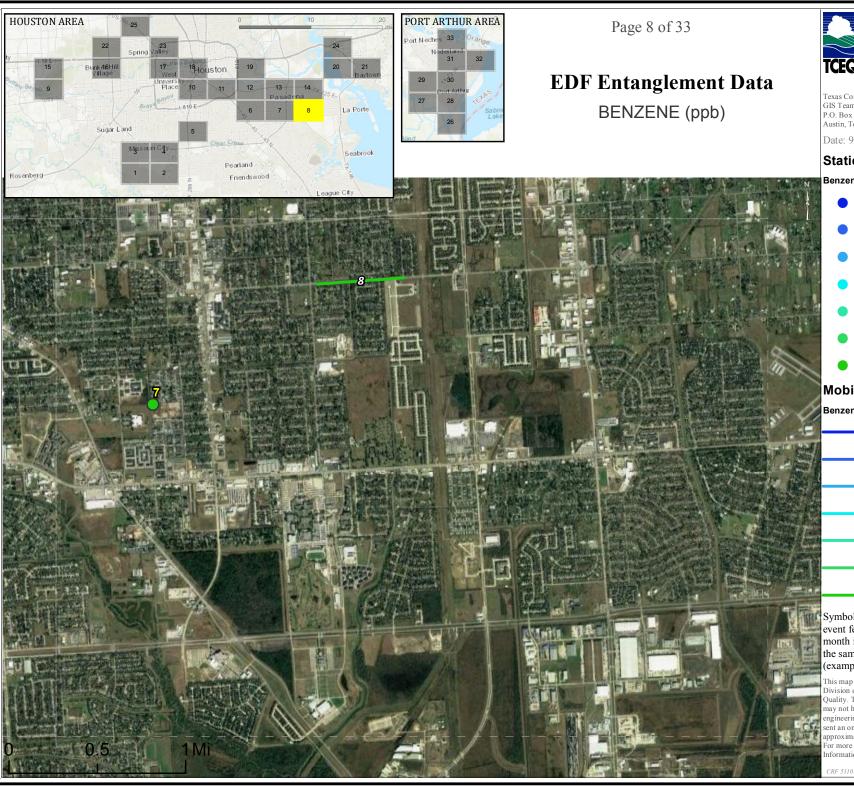
Symbol Notes: The number label on event features refers to the day of the month in September of 2017 on which the sampling event occurred. (example: 9/7/2017 = 7)

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CRF 511047RequestD20170922_BENZENE









Protecting Texas by Reducing and Preventing Pollution

Texas Commission on Environmental Quality GIS Team (Mail Code 197) P.O. Box 13087 Austin, Texas 78711-3087

Date: 9/27/2017

Static Sampling Events

- 78.29 185.92
- 20.00 78.28
- 7.22 19.99
- 1.11 7.21
- 0.63 1.10
- 0.29 0.62
- 0 0.28

Mobile Sampling Events

BenzenePPB

78.29 - 185.92

20.00 - 78.28

7.22 - 19.99

1.11 - 7.21

0.63 - 1.10

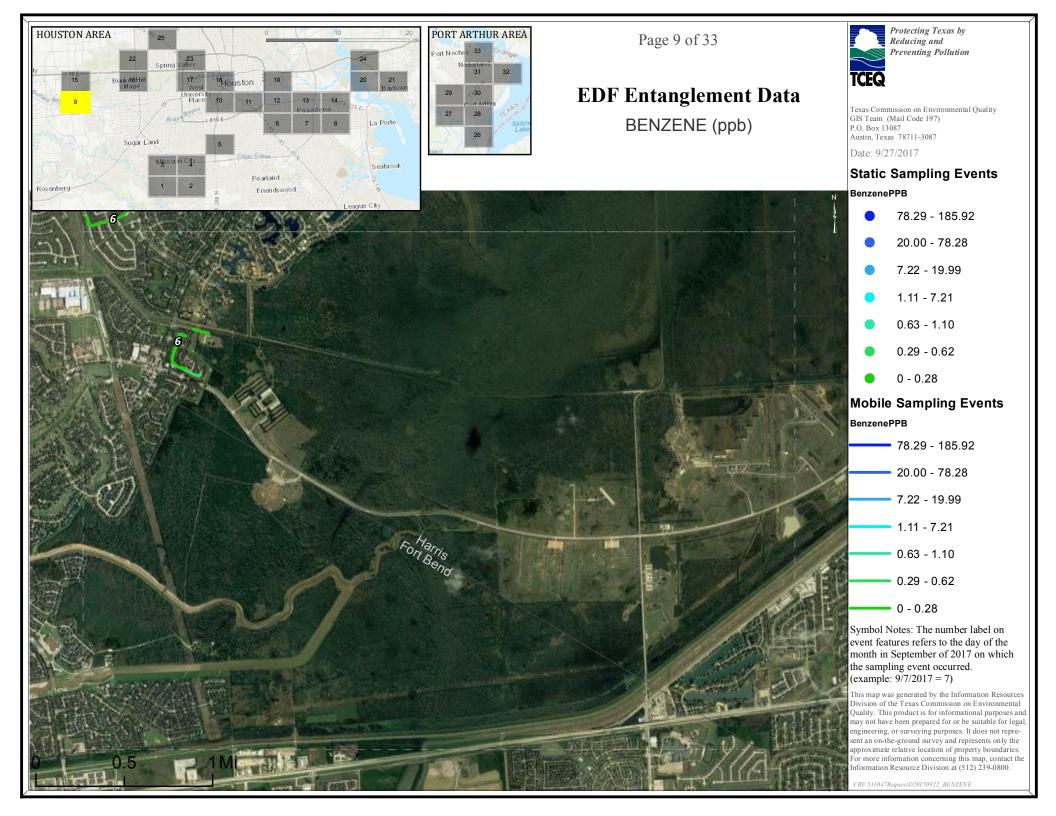
0.29 - 0.62

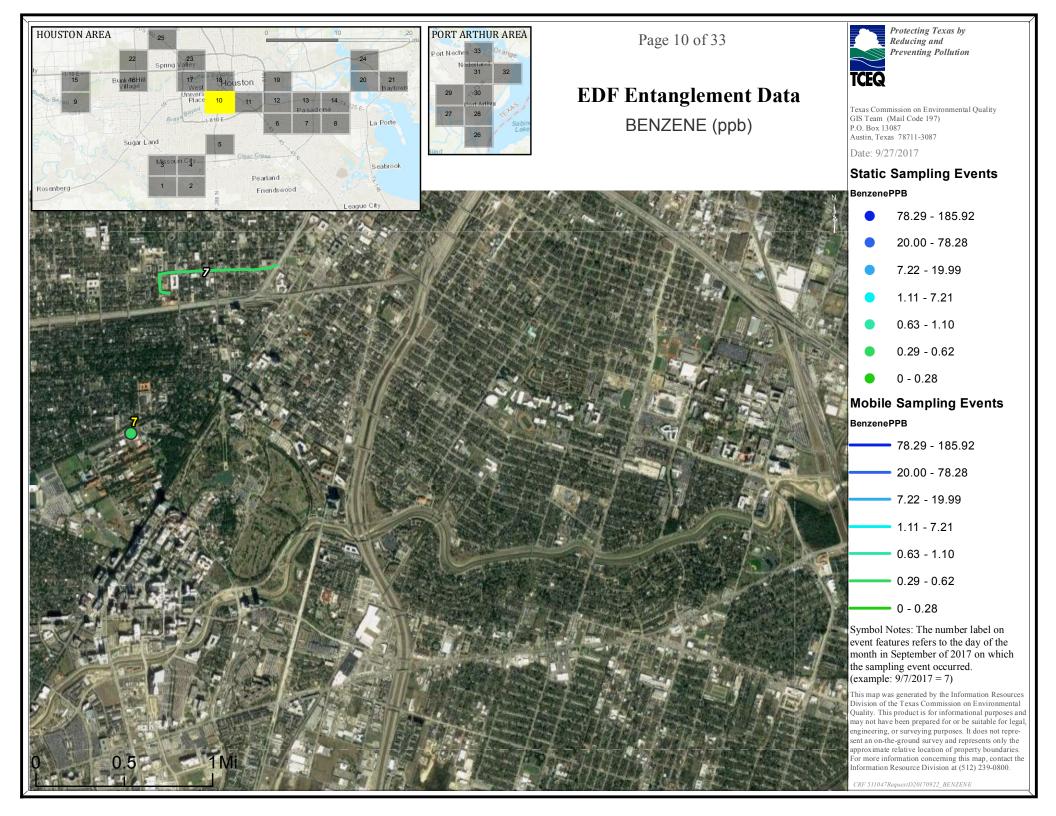
0 - 0.28

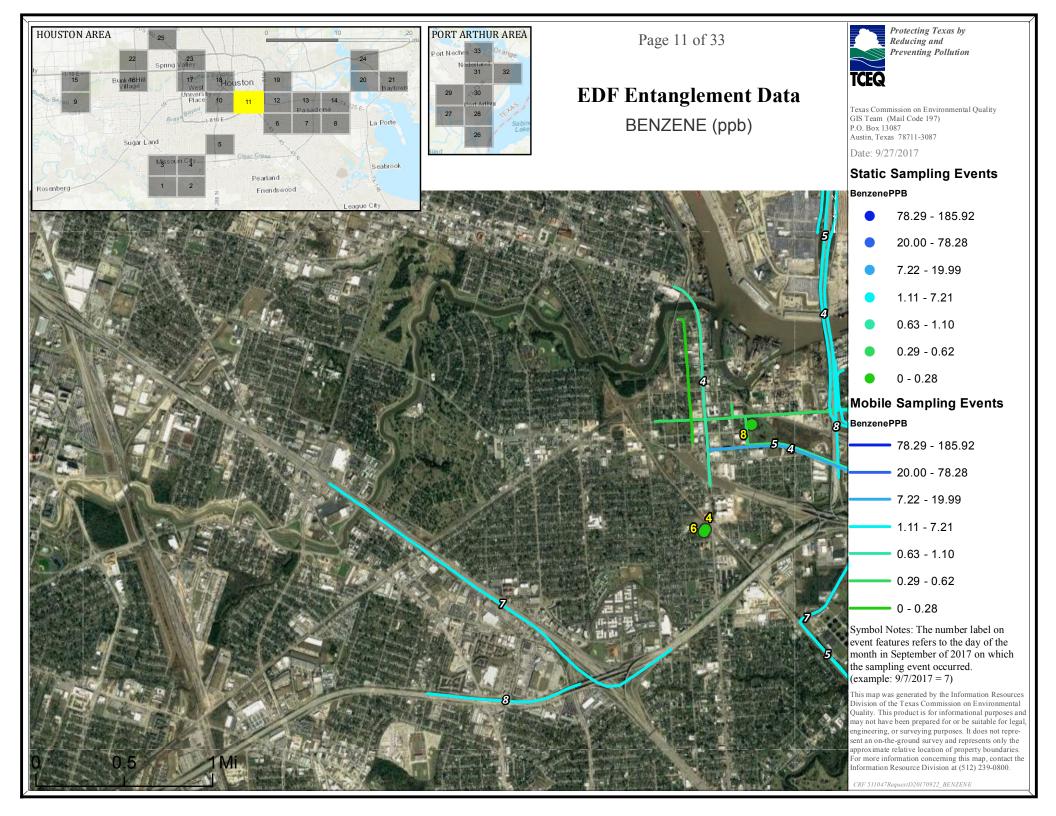
Symbol Notes: The number label on event features refers to the day of the month in September of 2017 on which the sampling event occurred. (example: 9/7/2017 = 7)

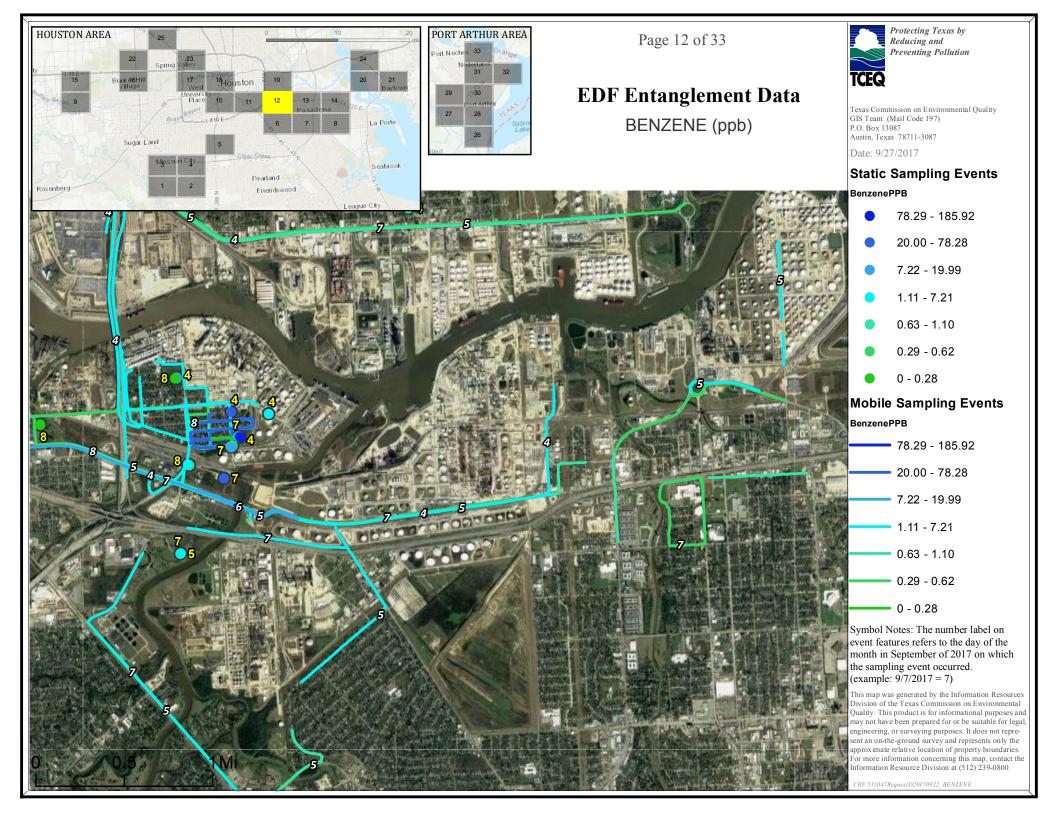
This map was generated by the Information Resources Division of the Texas Commission on Environmental Quality. This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. It does not represent an on-the-ground survey and represents only the approximate relative location of property boundaries. For more information concerning this map, contact the Information Resource Division at (512) 239-0800.

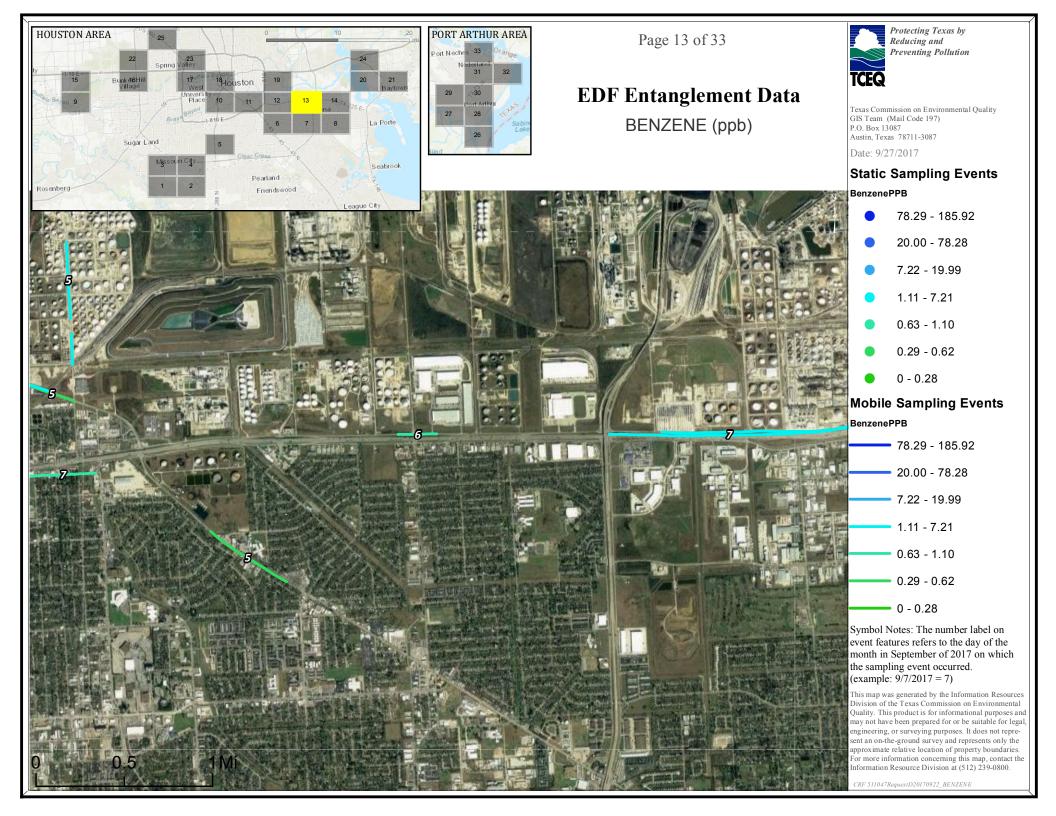
CRF 511047RequestD20170922_BENZENE

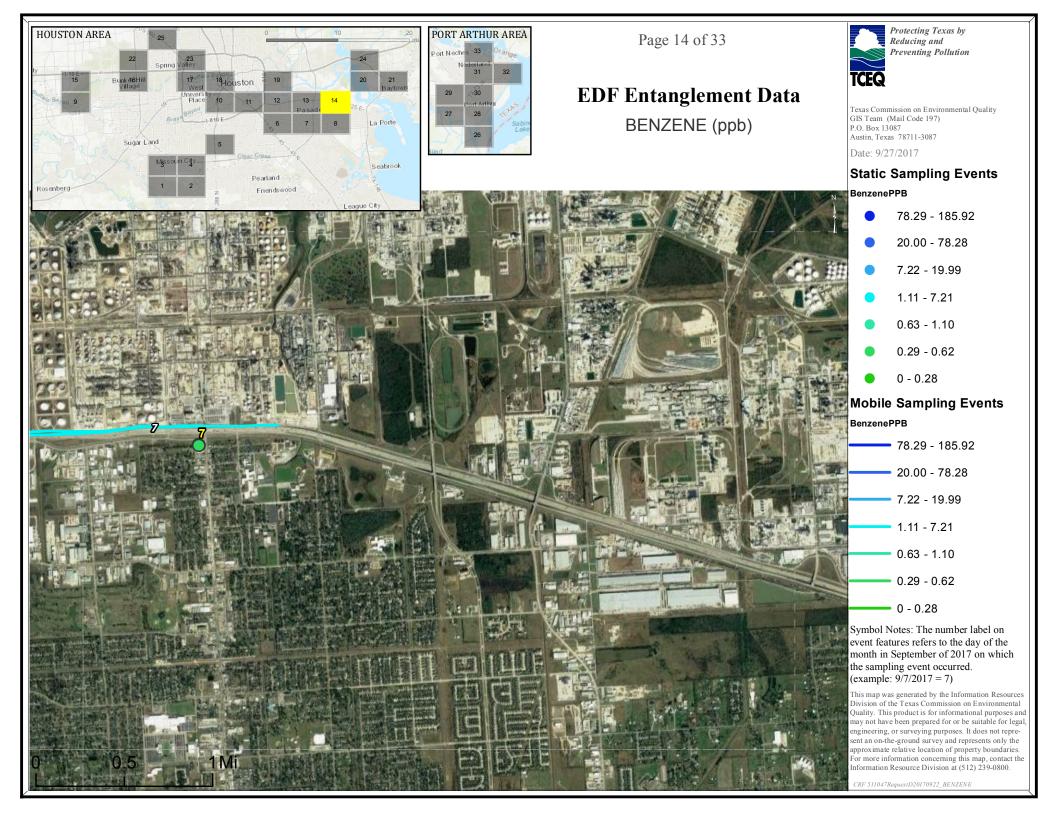


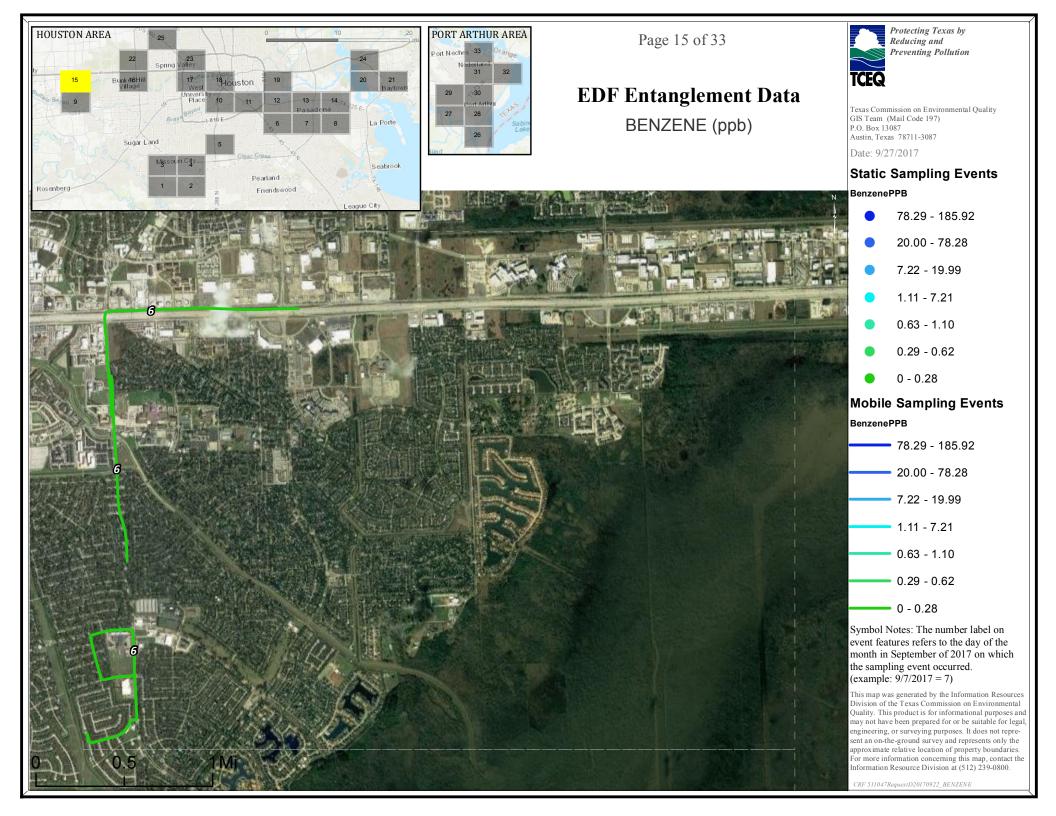


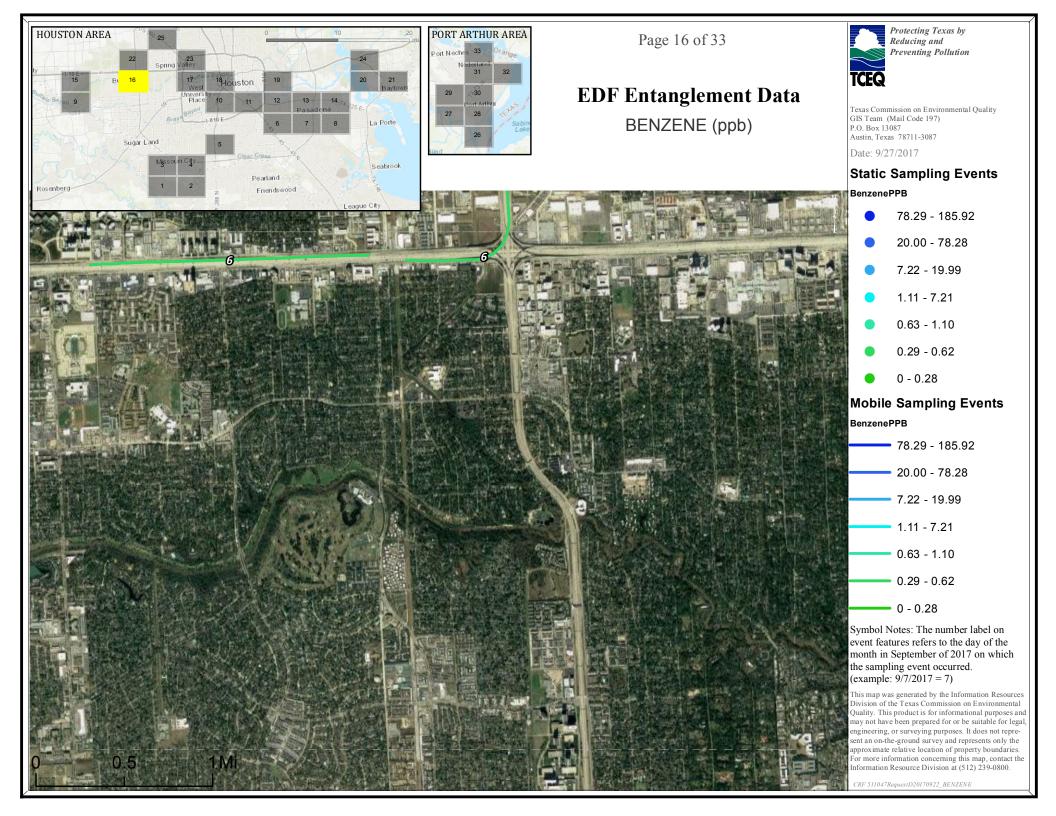


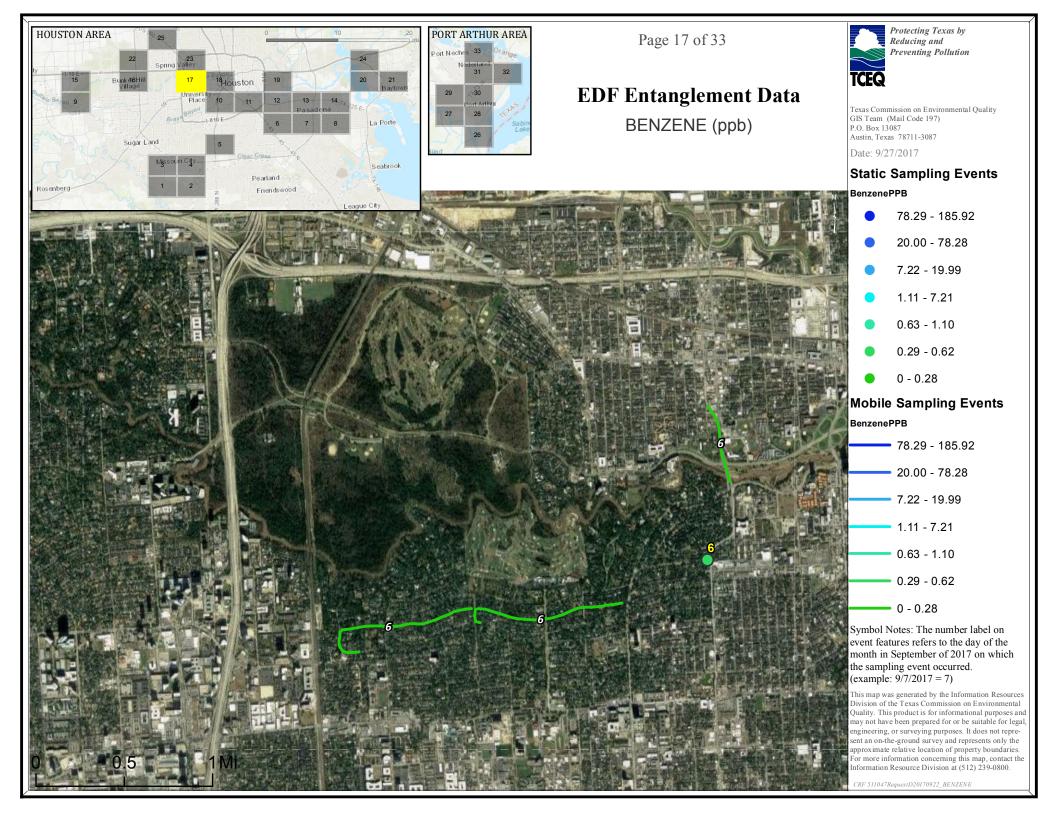


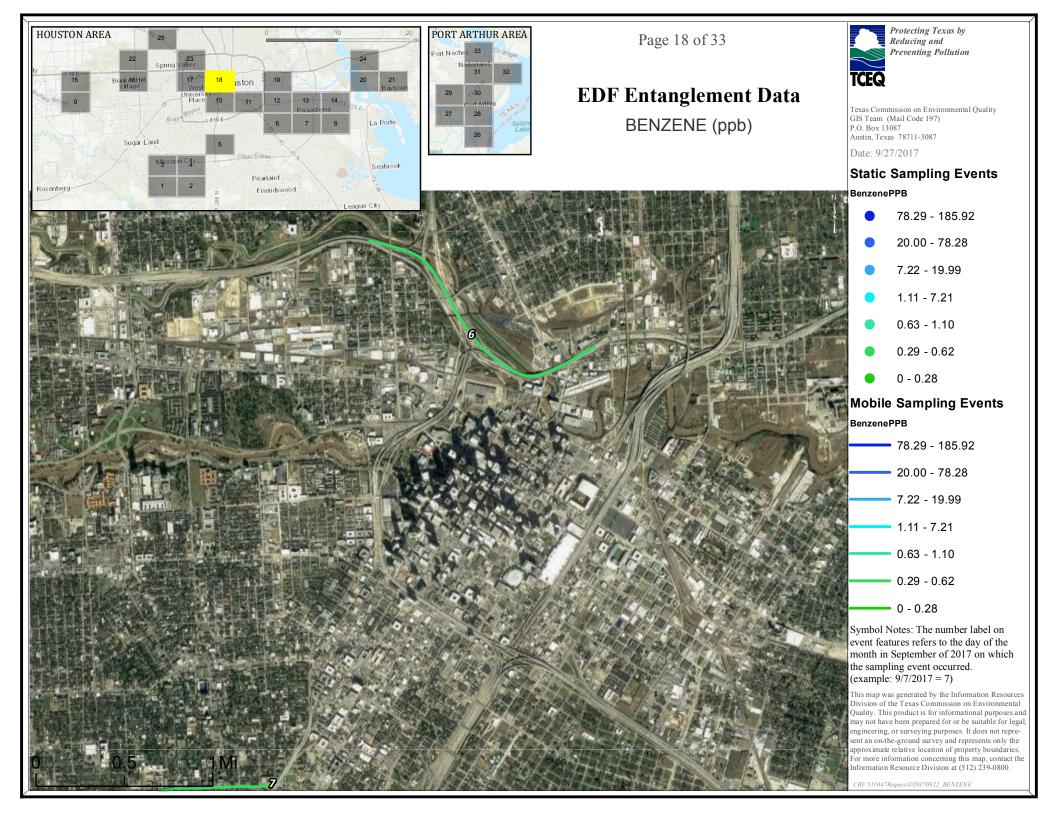


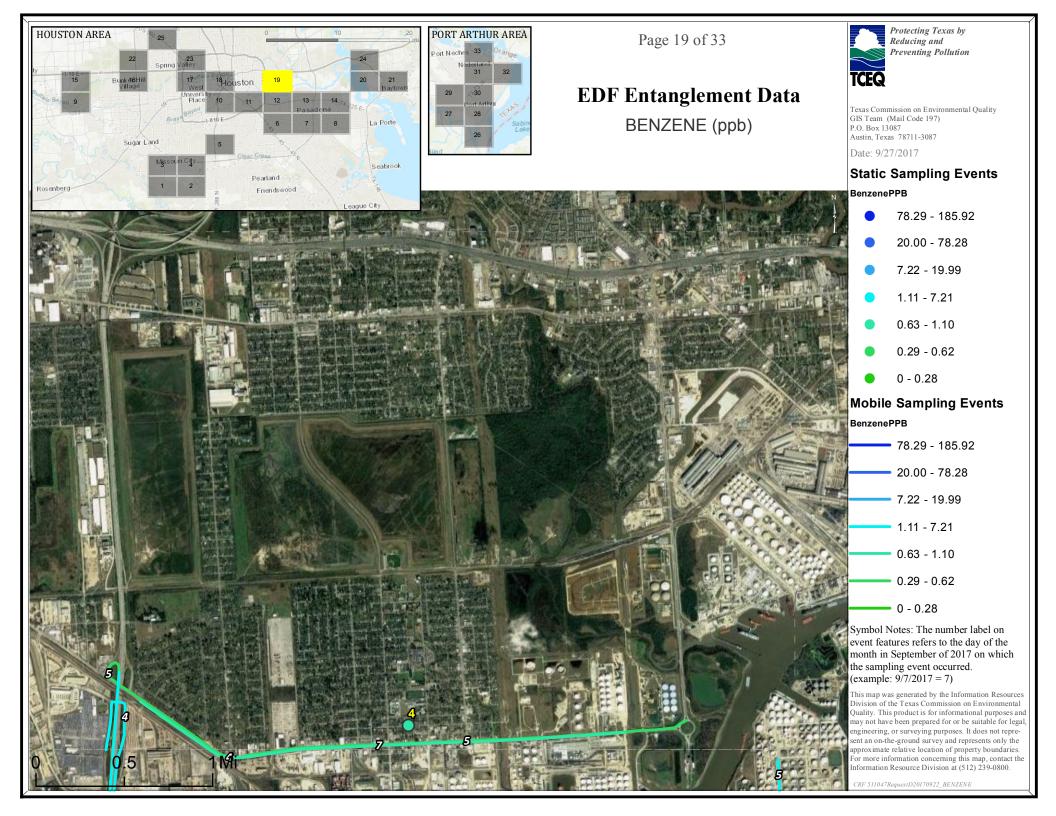


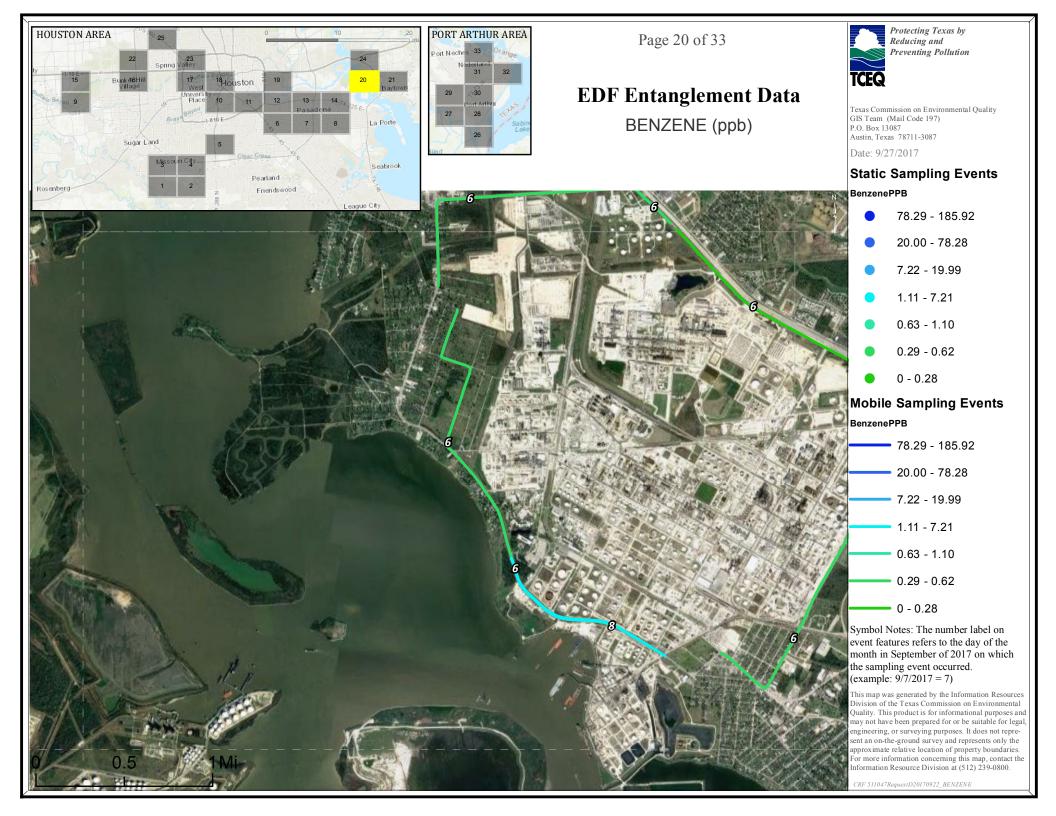


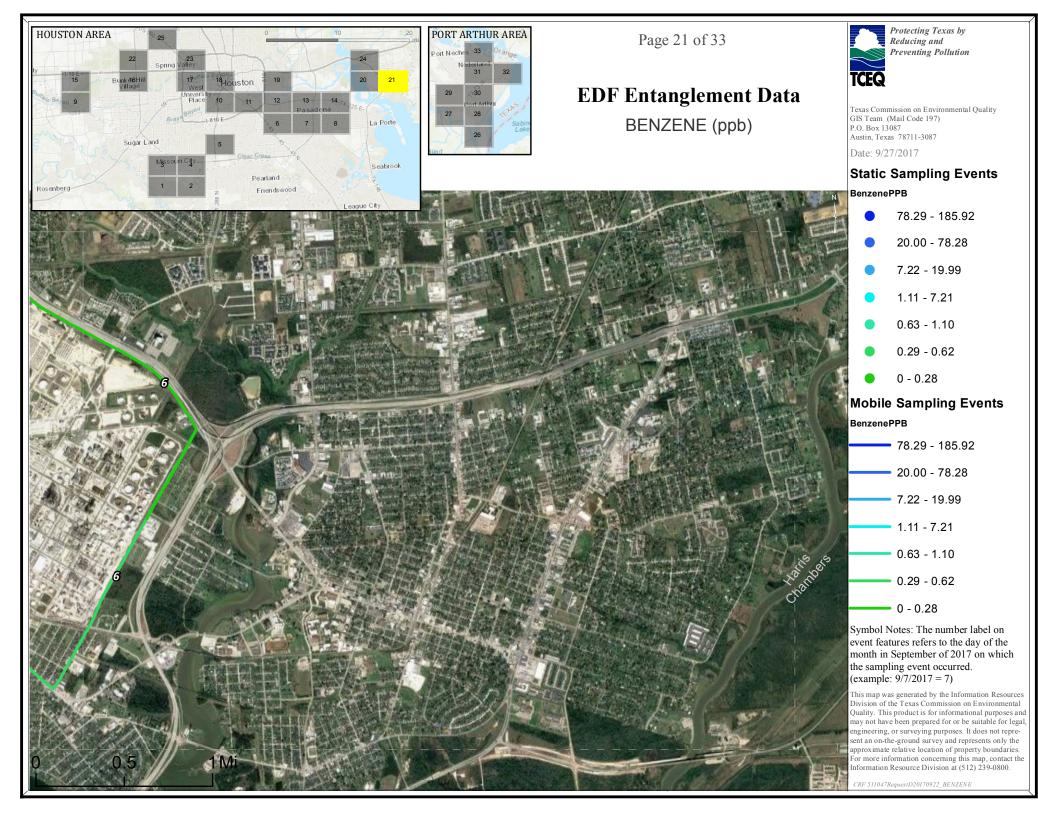


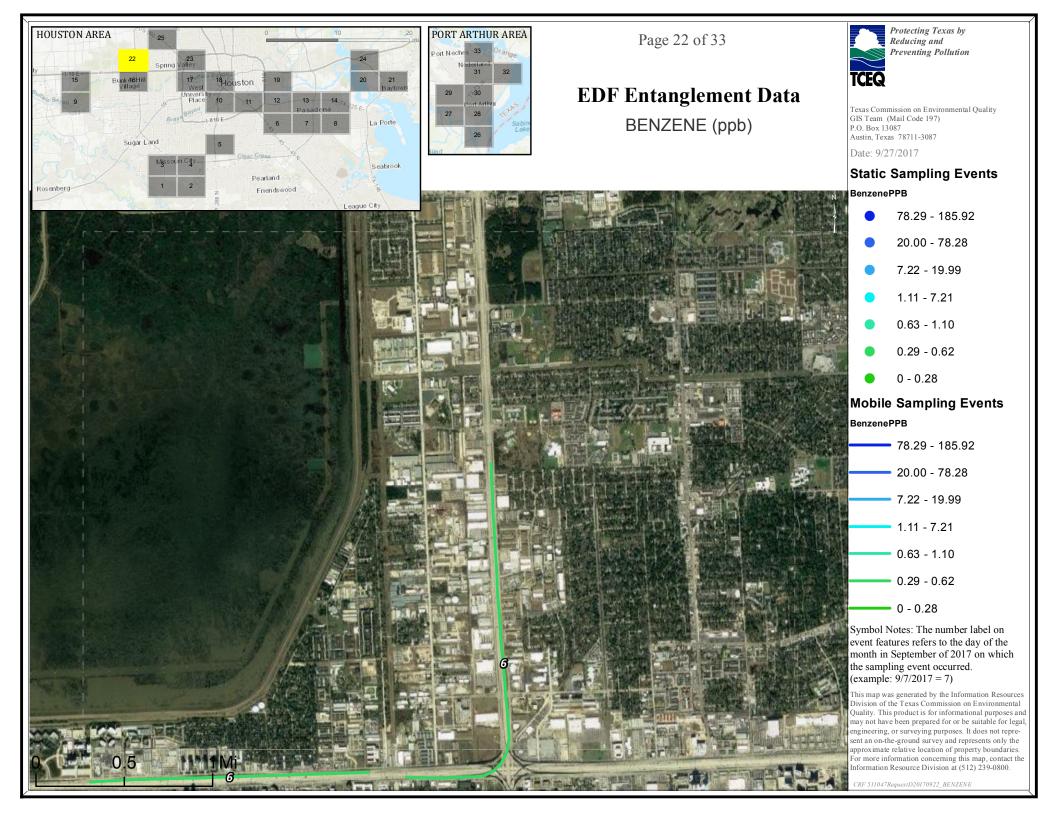


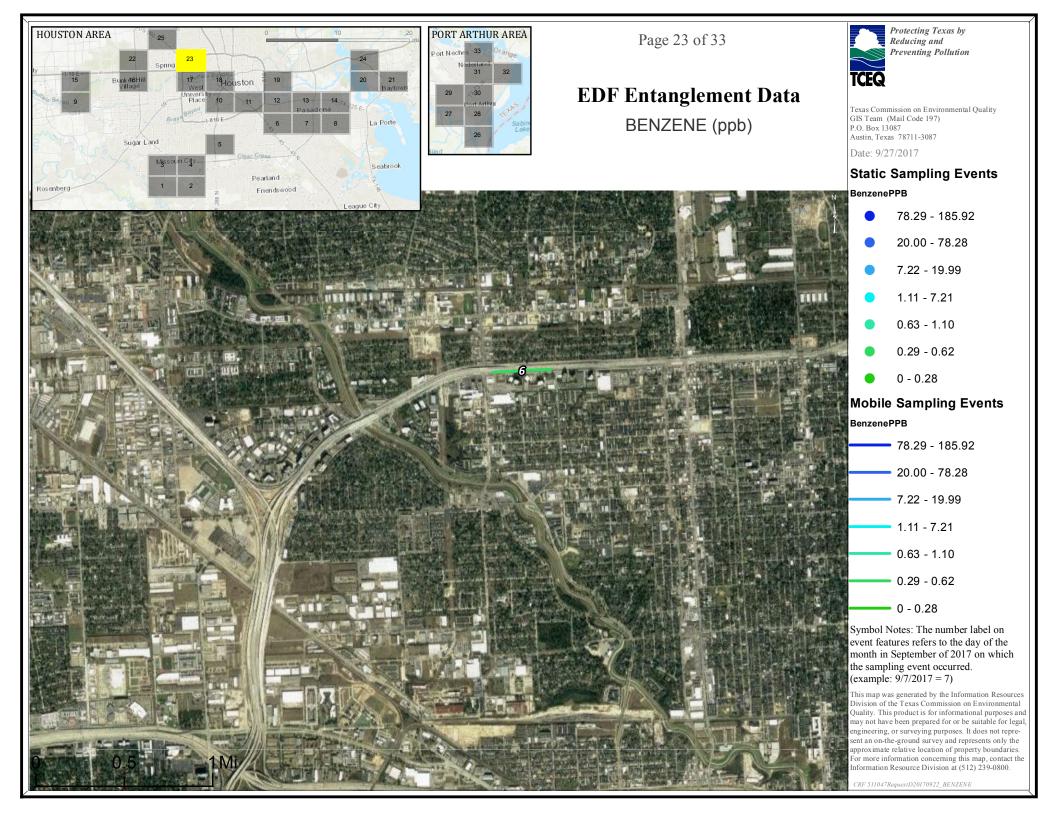


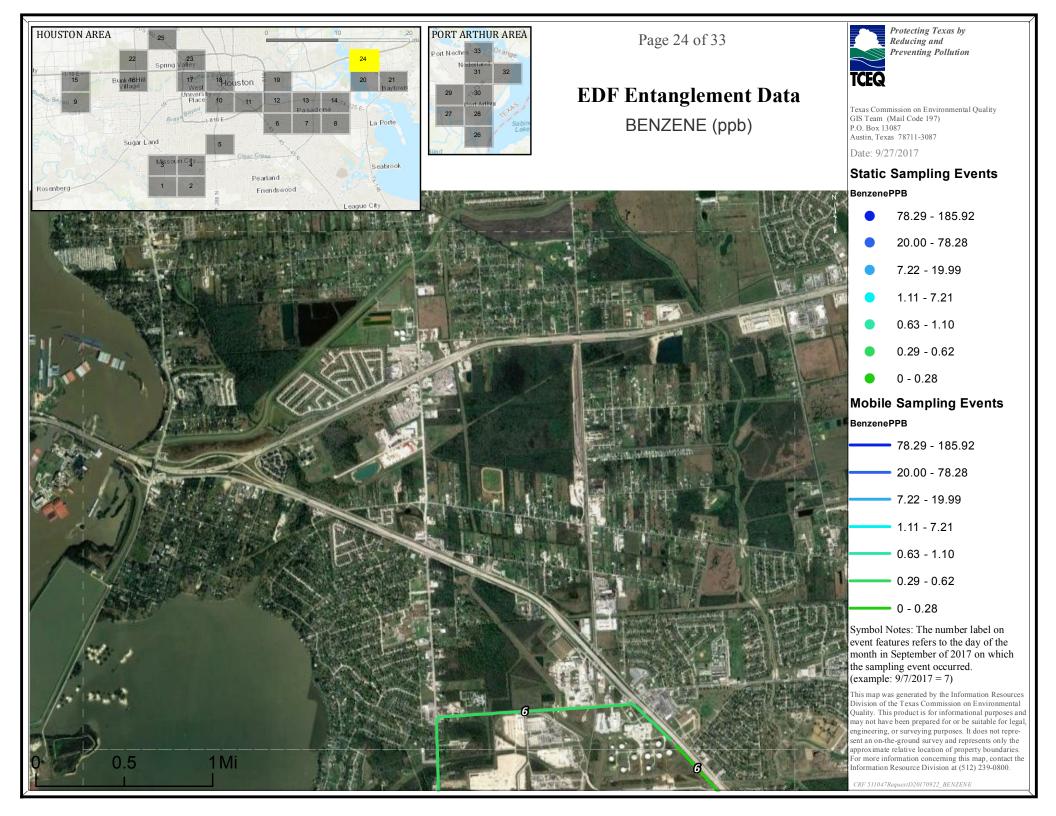


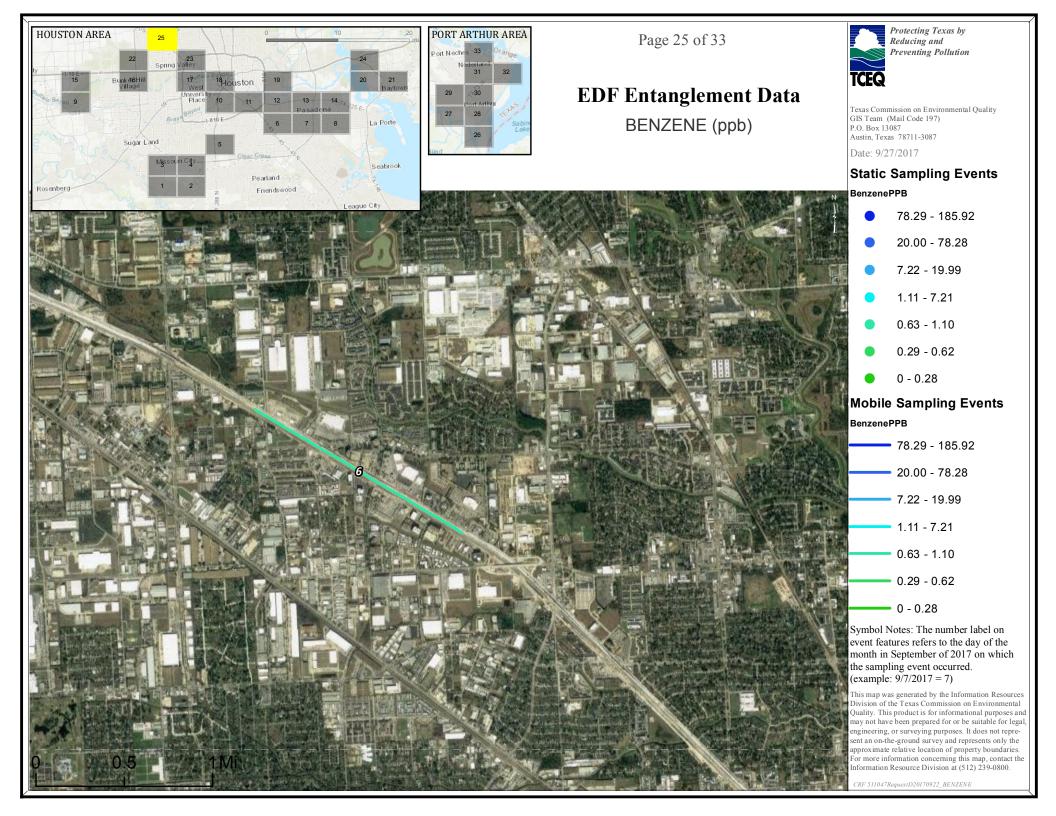




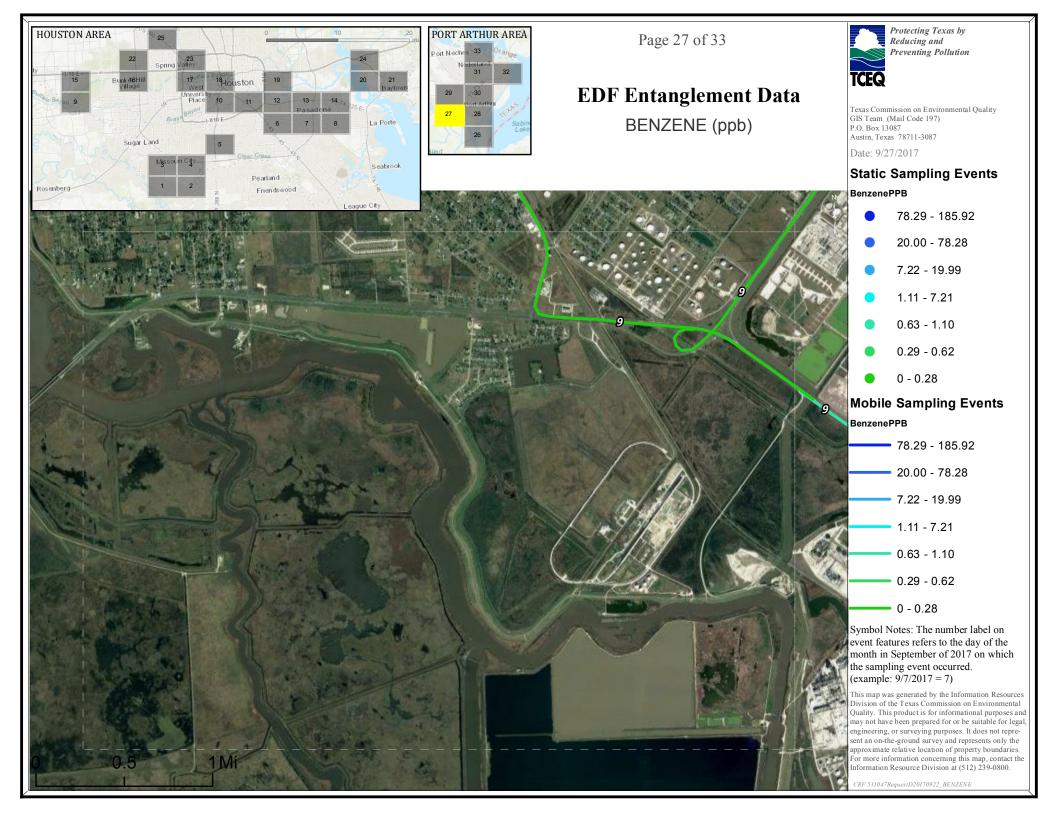


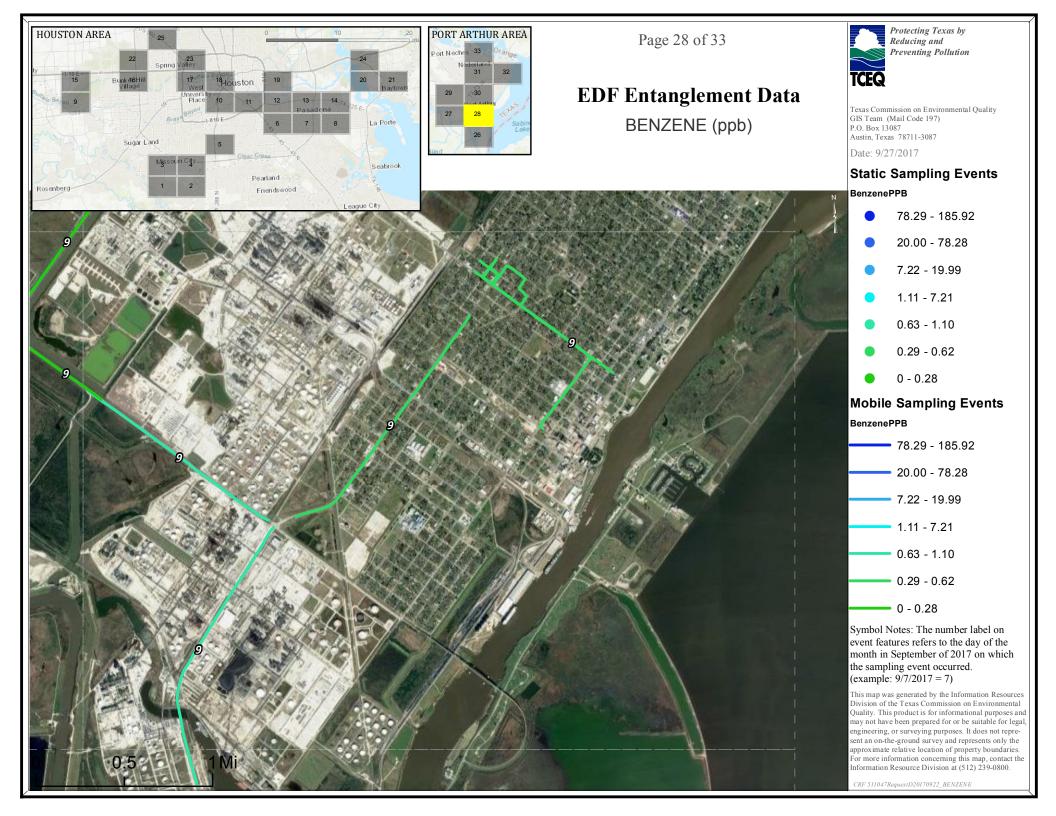


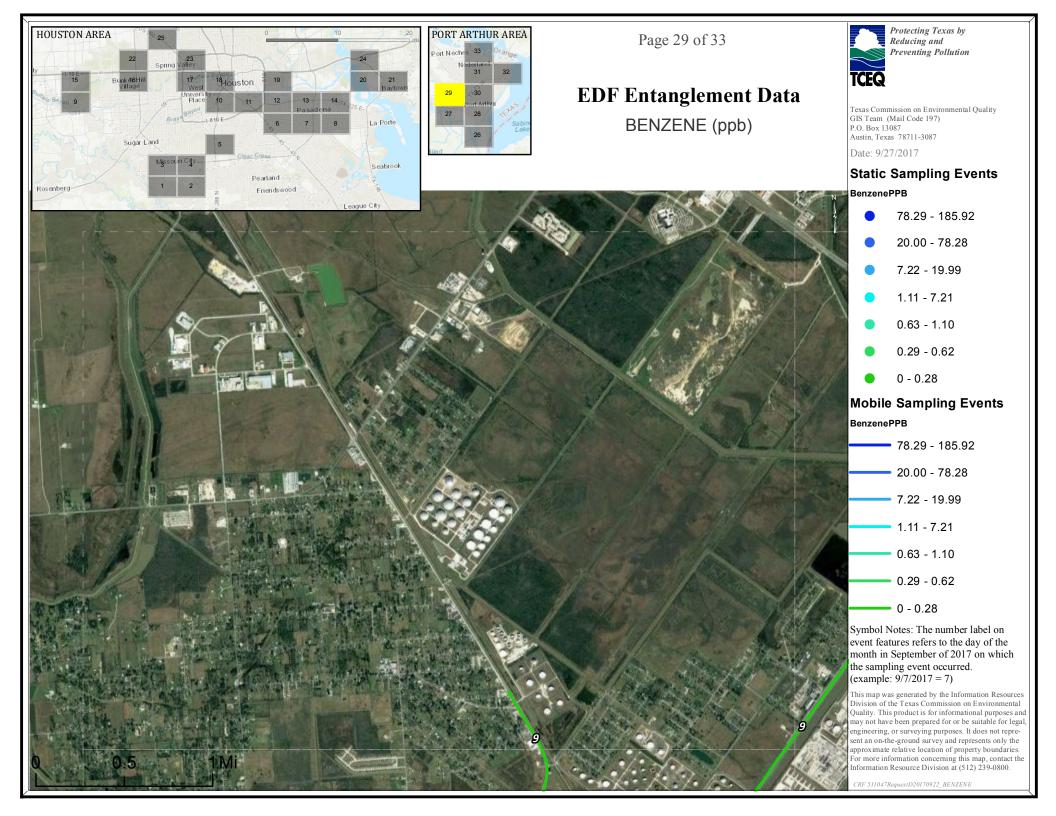


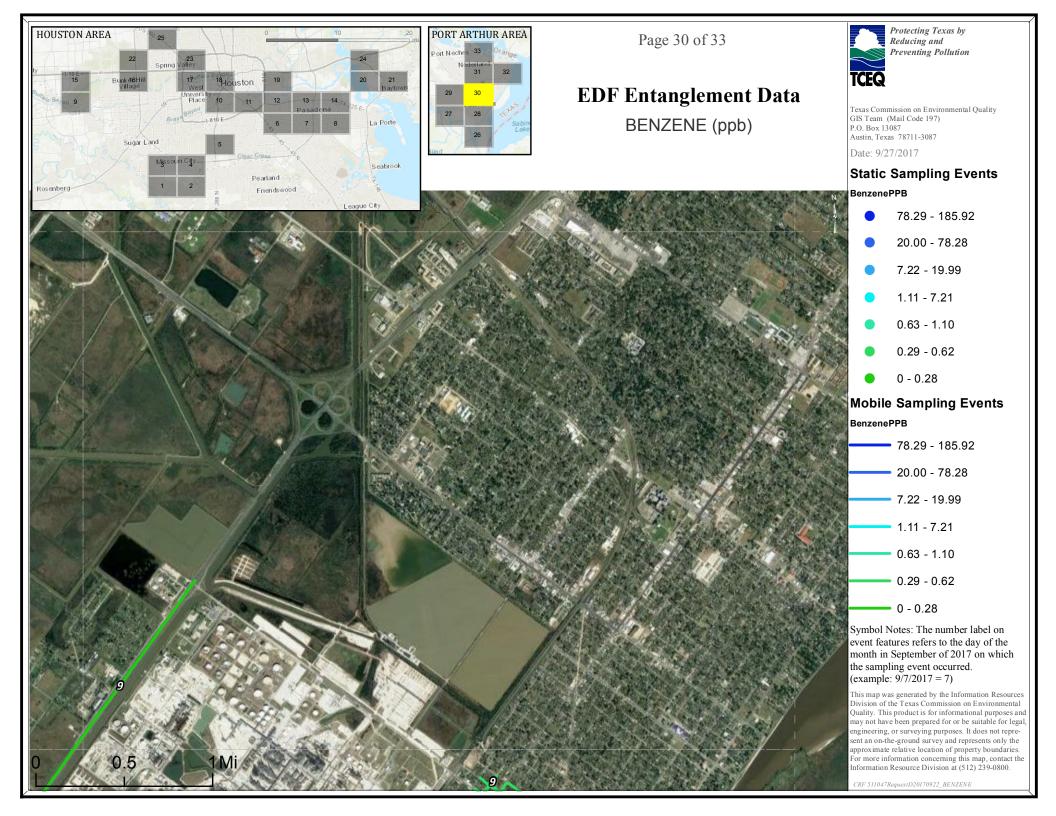


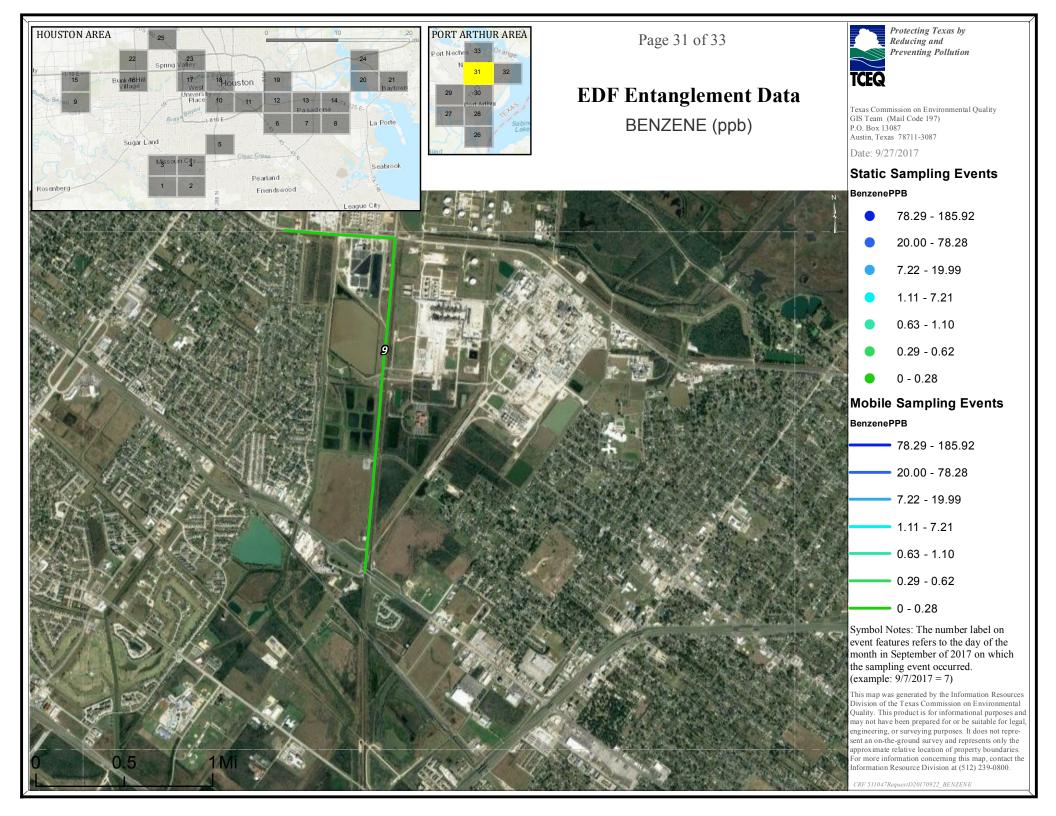


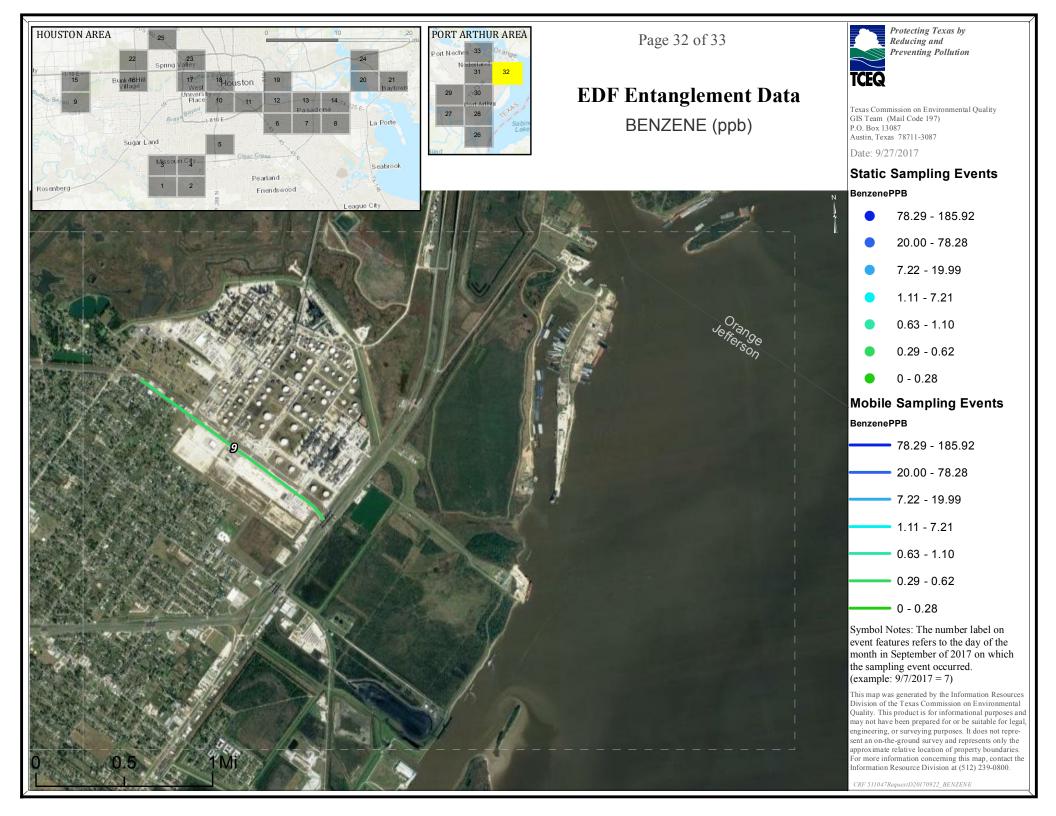


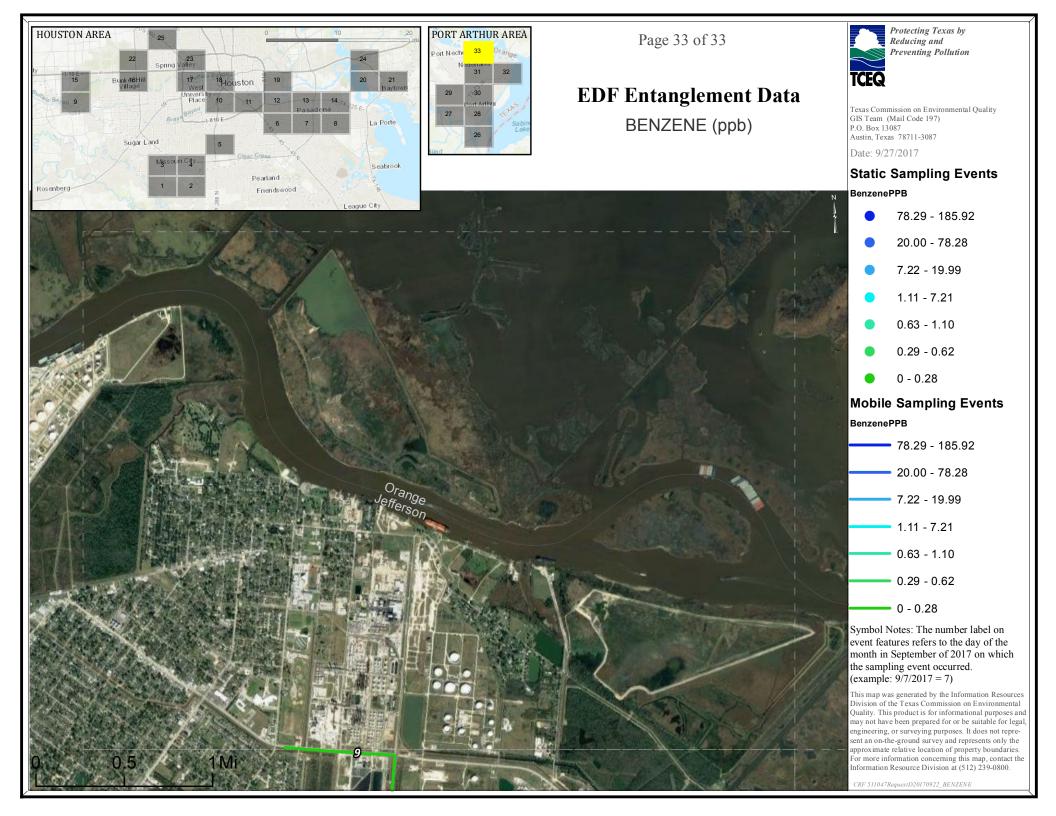


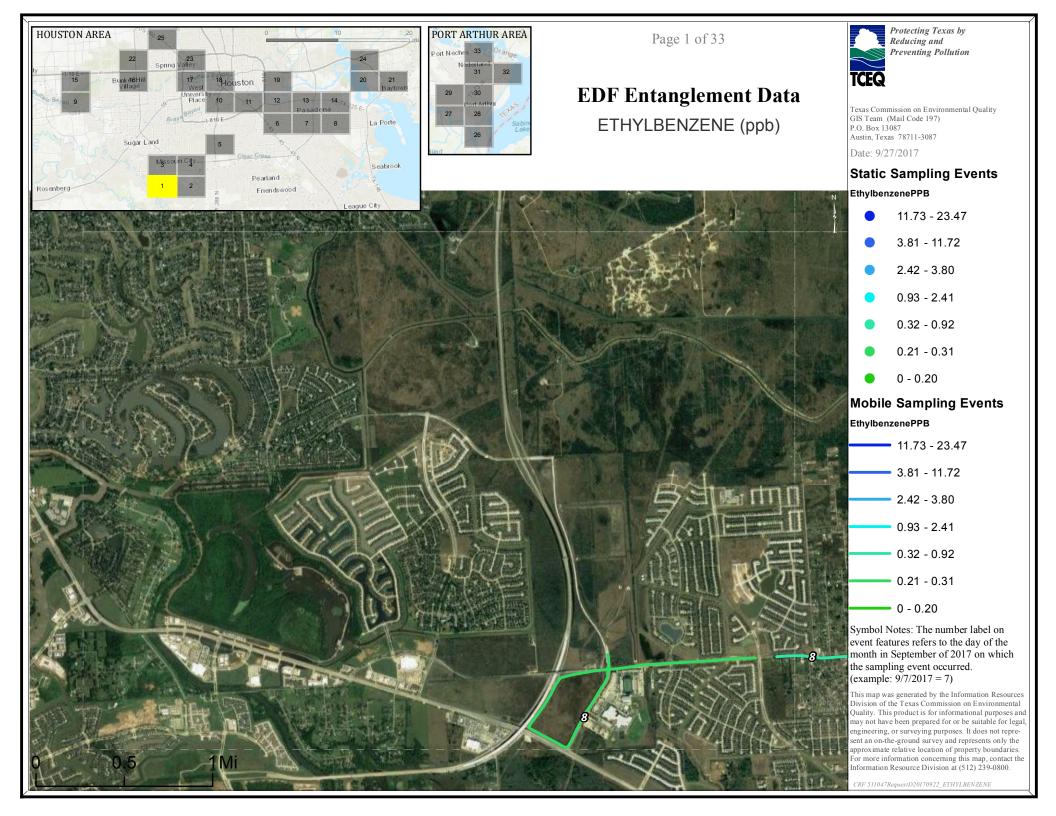


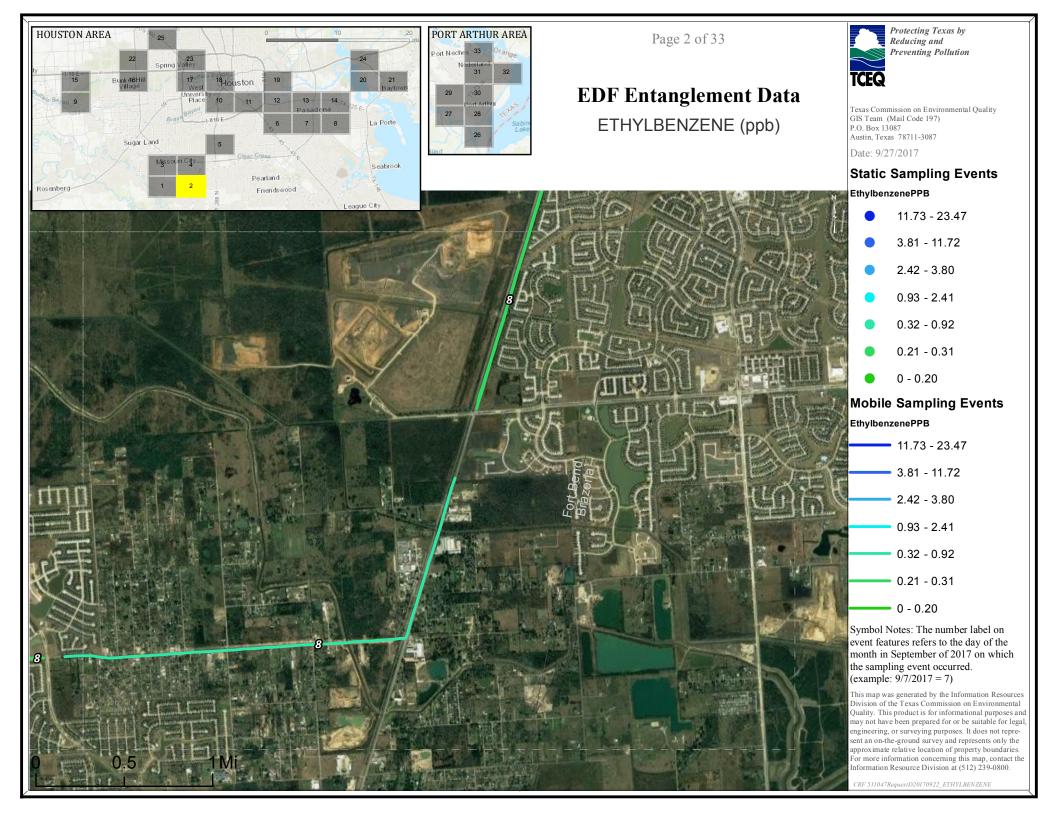


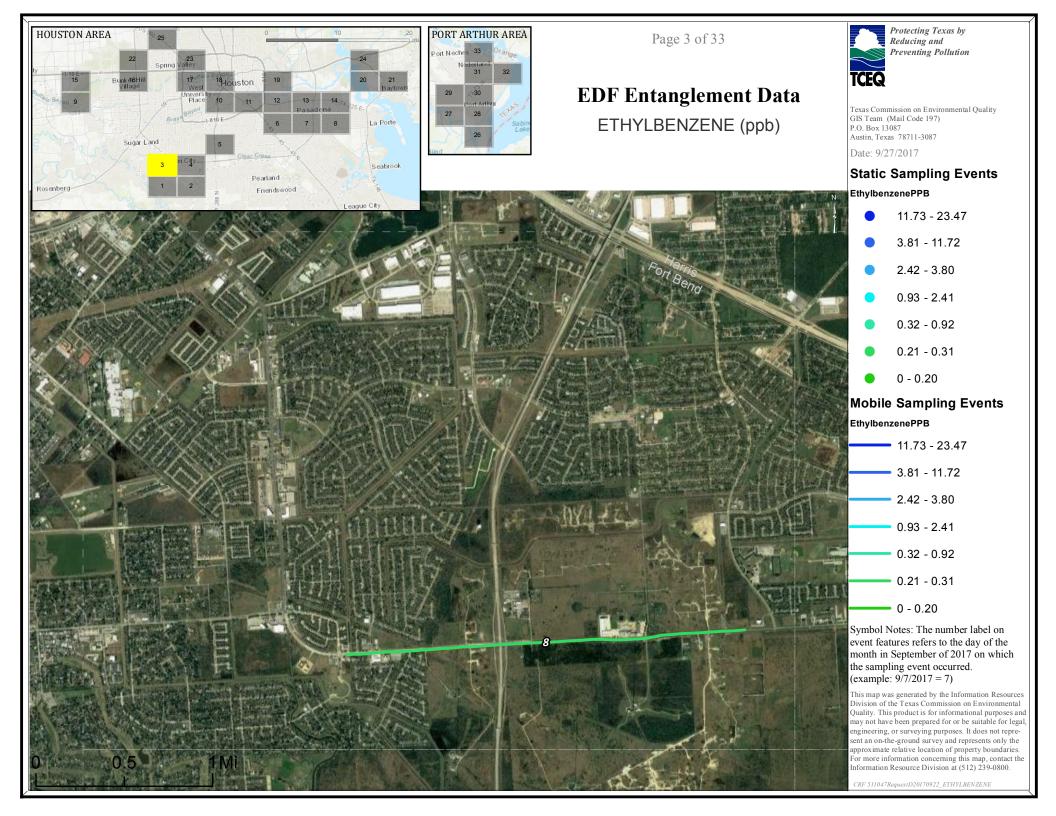


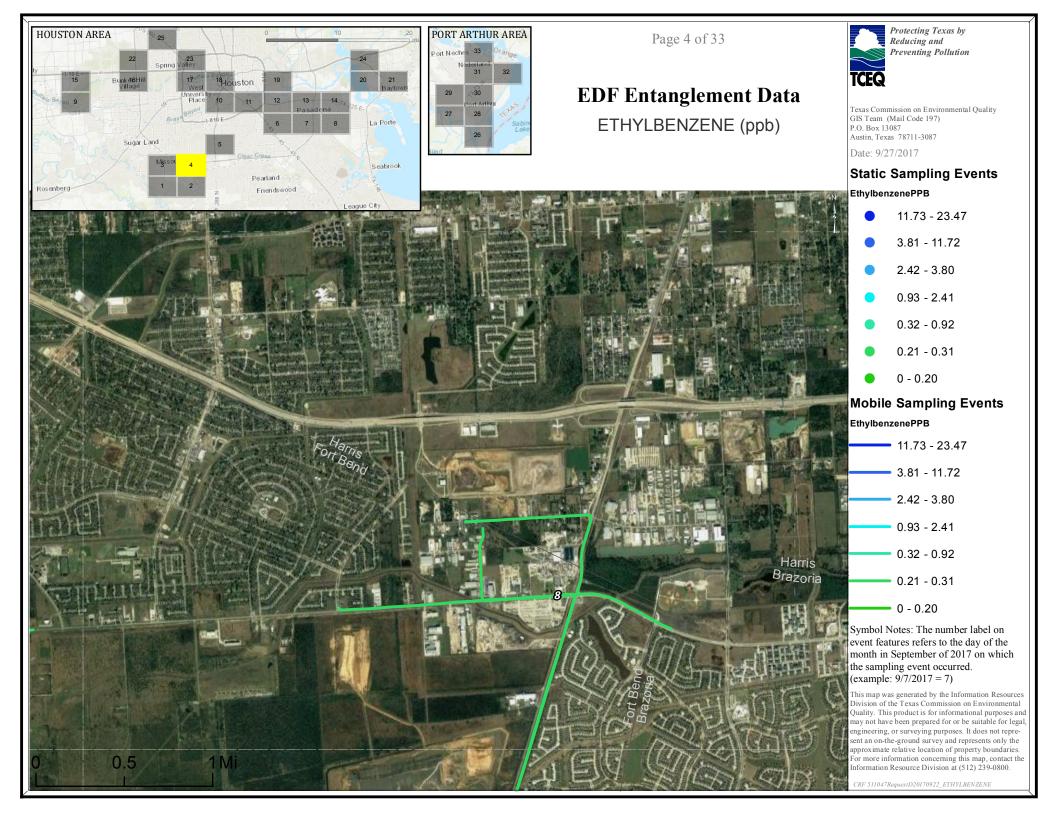


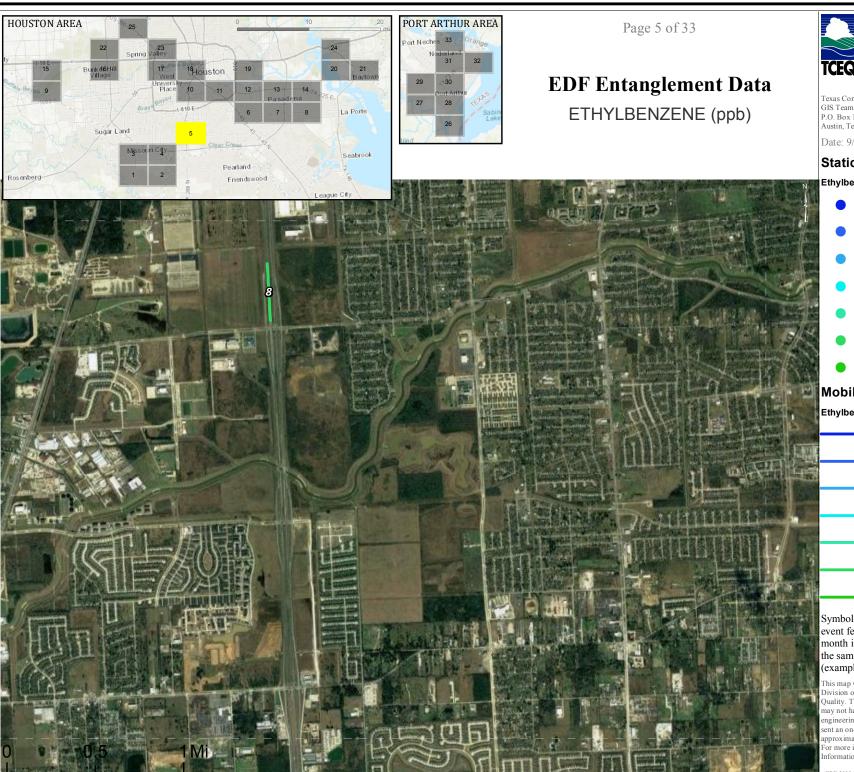












Protein Reduction Prevention

Protecting Texas by Reducing and Preventing Pollution

Texas Commission on Environmental Quality GIS Team (Mail Code 197) P.O. Box 13087 Austin, Texas 78711-3087

Date: 9/27/2017

Static Sampling Events

EthylbenzenePPB

- 11.73 23.47
- 3.81 11.72
- 2.42 3.80
- 0.93 2.41
- 0.32 0.92
- 0.21 0.31
- 0 0.20

Mobile Sampling Events

EthylbenzenePPB

11.73 - 23.47

3.81 - 11.72

2.42 - 3.80

0.93 - 2.41

0.32 - 0.92

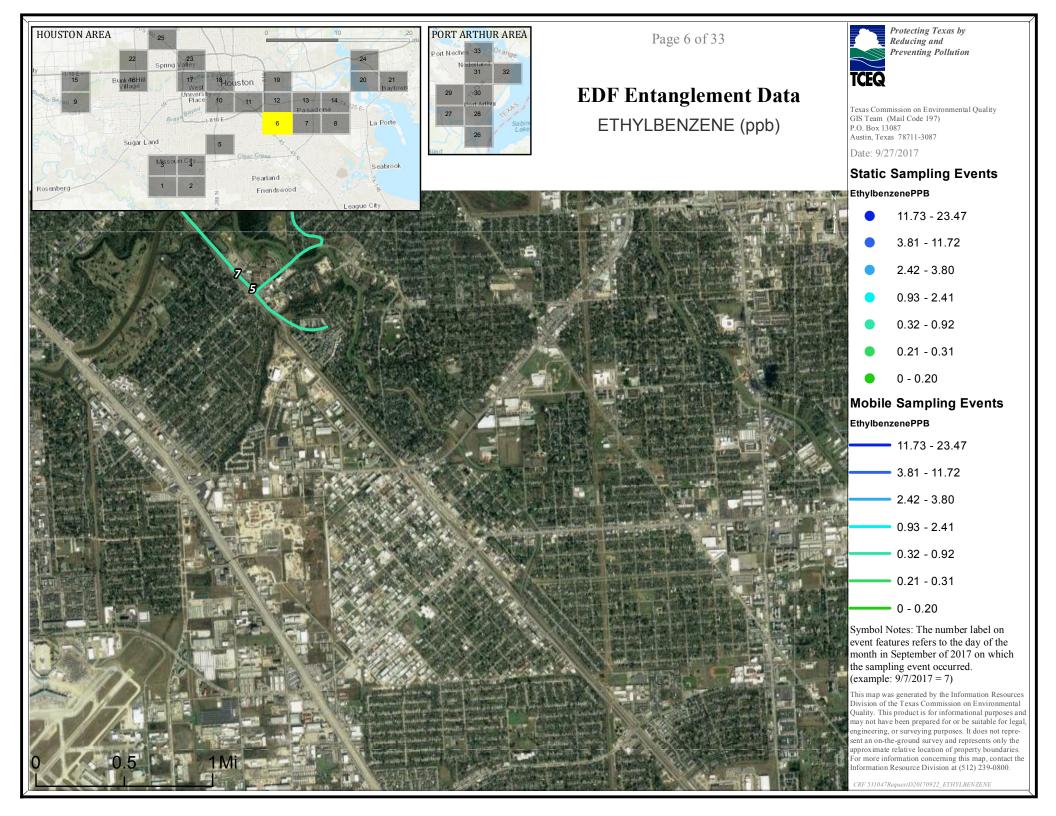
0.21 - 0.31

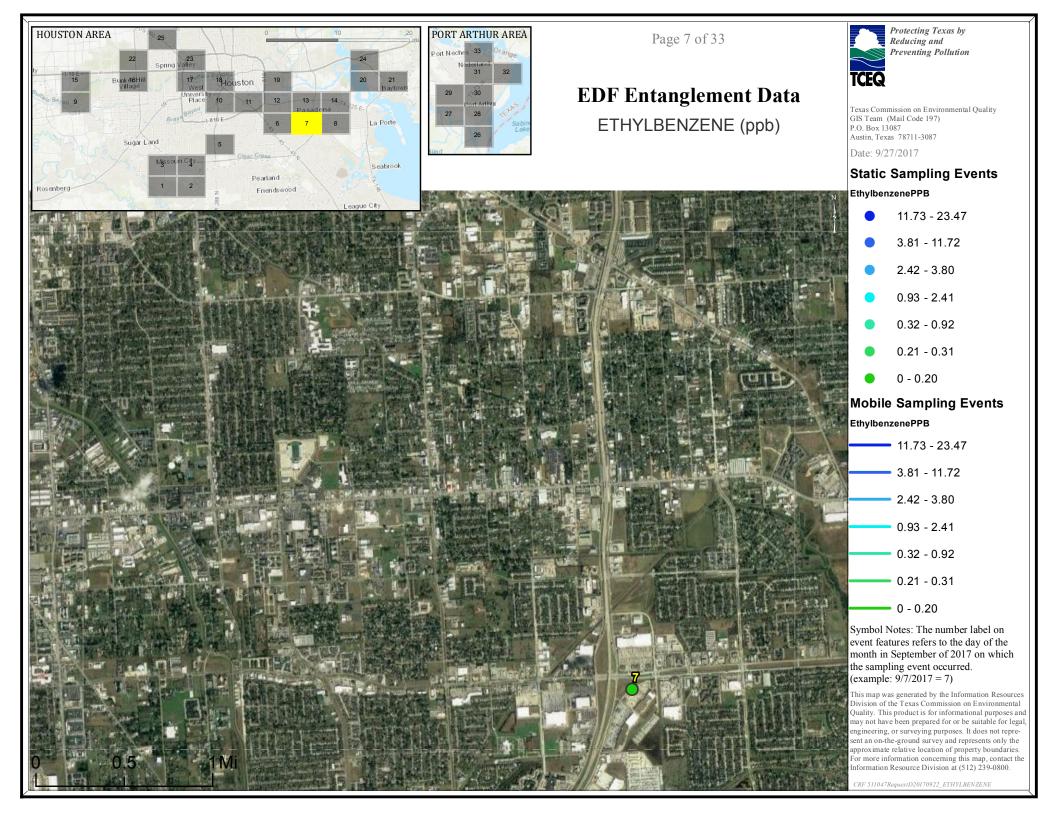
0 - 0.20

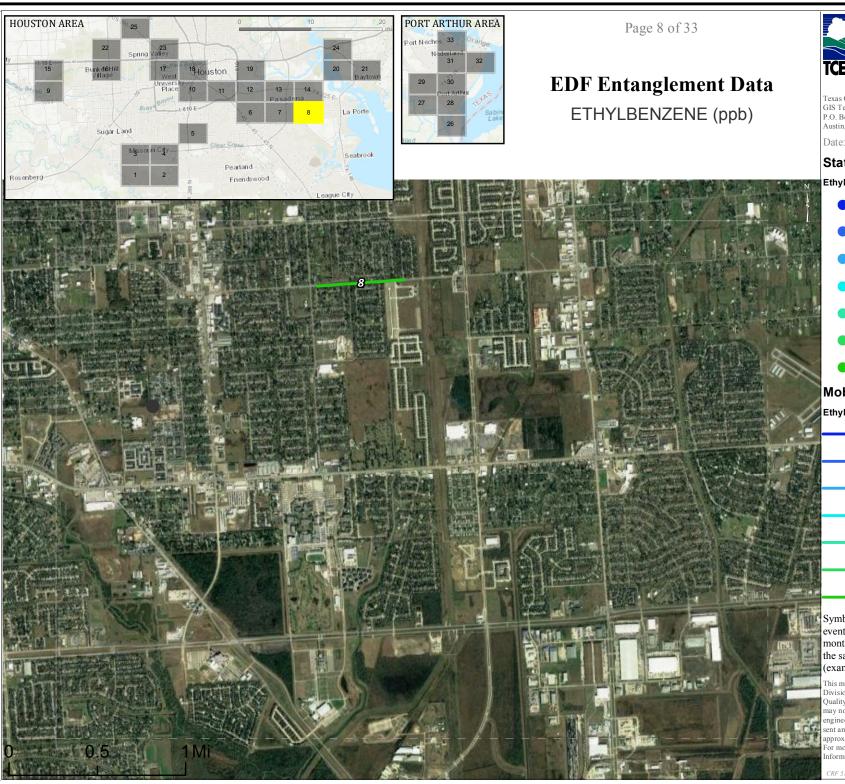
Symbol Notes: The number label on event features refers to the day of the month in September of 2017 on which the sampling event occurred. (example: 9/7/2017 = 7)

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CRF 511047RequestD20170922_ETHYLBENZENE







Protecting Reducing Preventin

Protecting Texas by Reducing and Preventing Pollution

Texas Commission on Environmental Quality GIS Team (Mail Code 197) P.O. Box 13087 Austin, Texas 78711-3087

Date: 9/27/2017

Static Sampling Events

EthylbenzenePPB

- 11.73 23.47
- 3.81 11.72
- 2.42 3.80
- 0.93 2.41
- 0.32 0.92
- 0.21 0.31
- 0 0.20

Mobile Sampling Events

EthylbenzenePPB

11.73 - 23.47

3.81 - 11.72

2.42 - 3.80

0.93 - 2.41

0.32 - 0.92

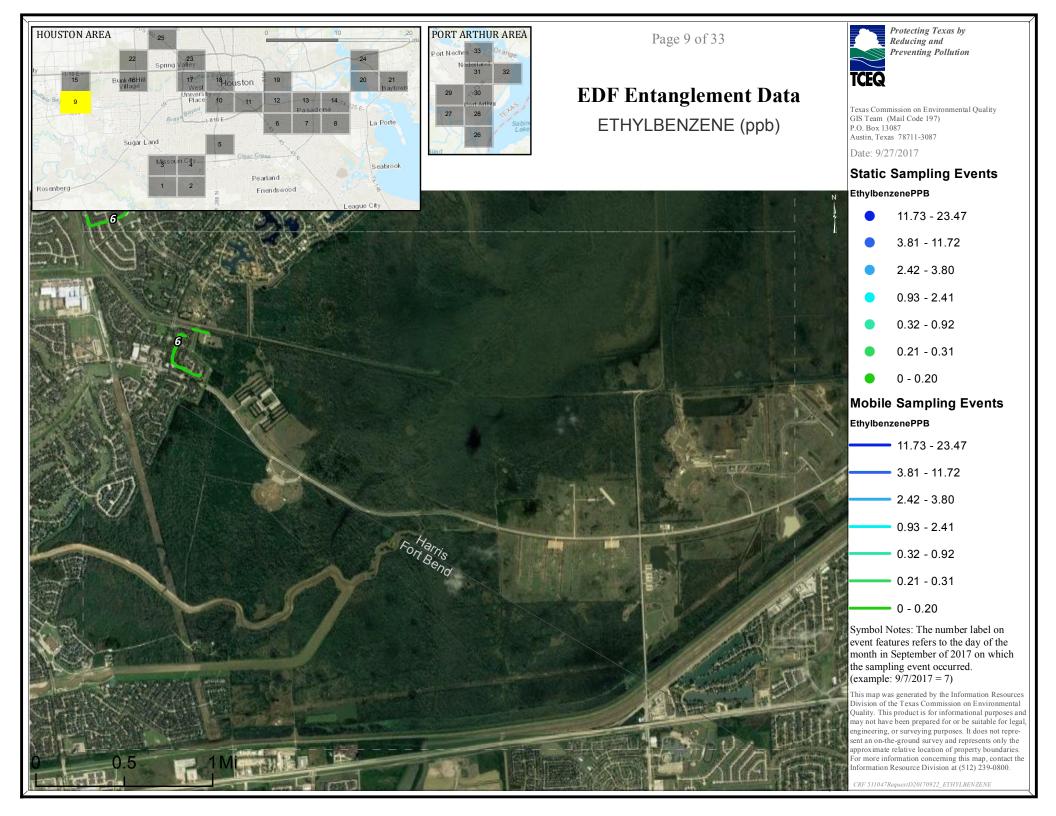
0.21 - 0.31

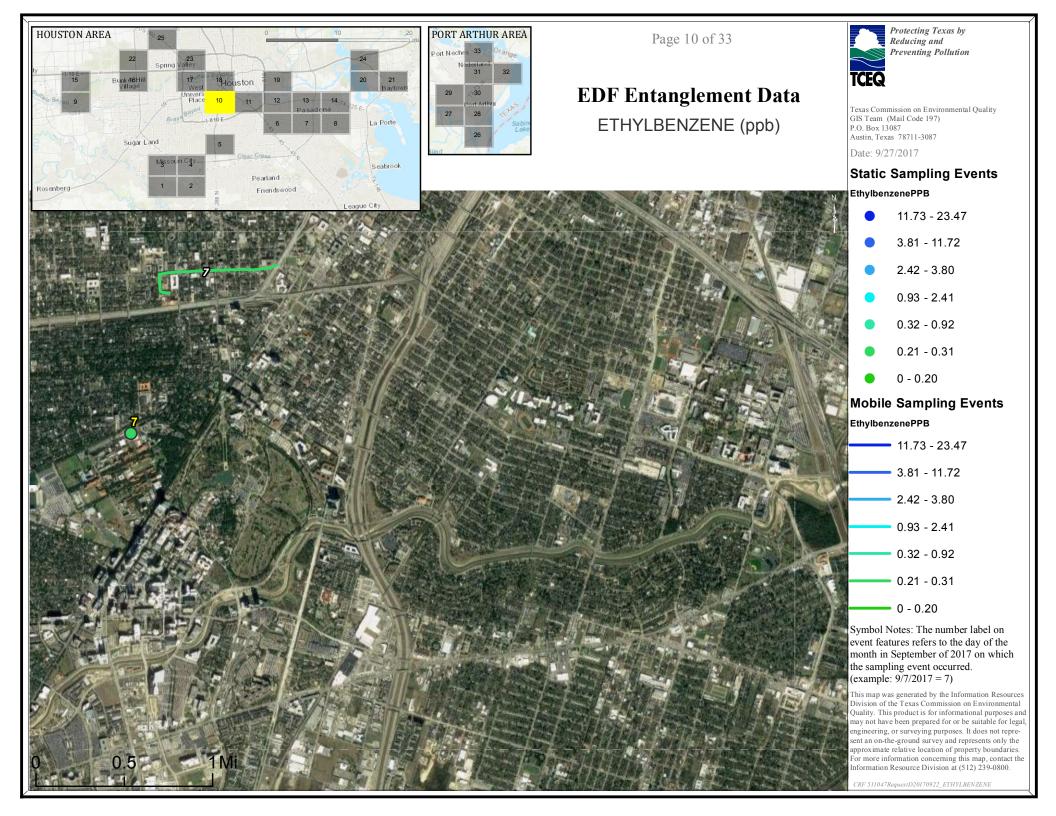
0 - 0.20

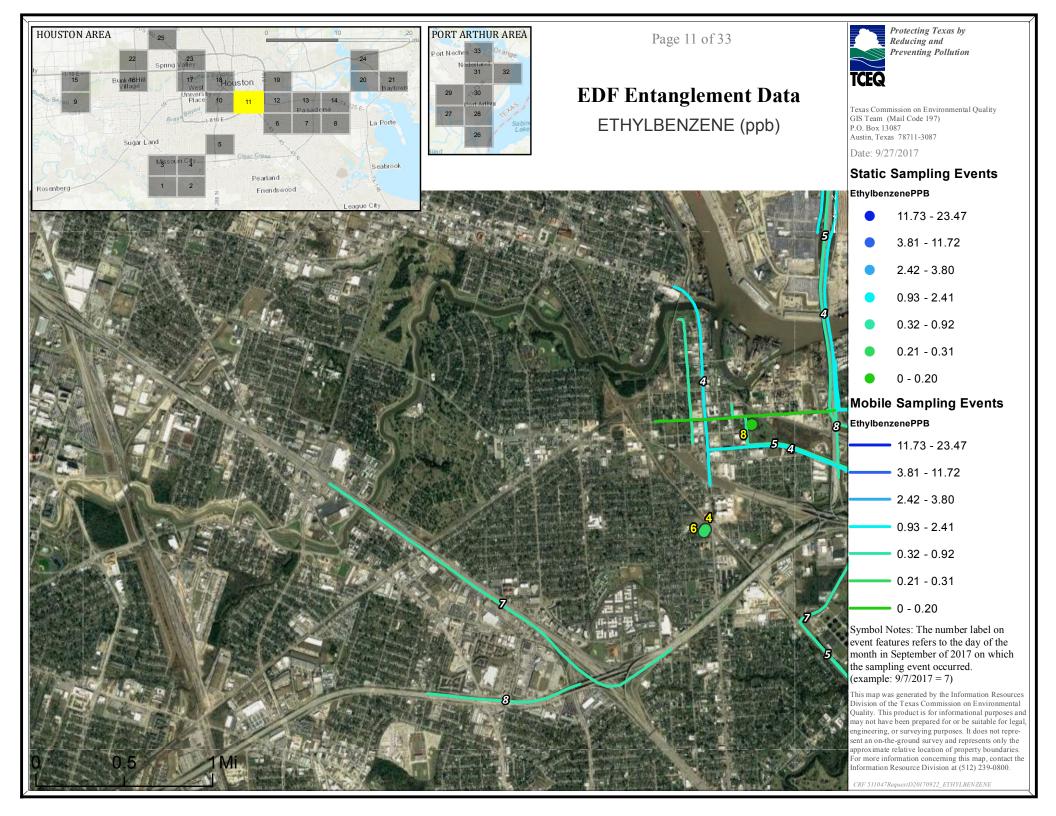
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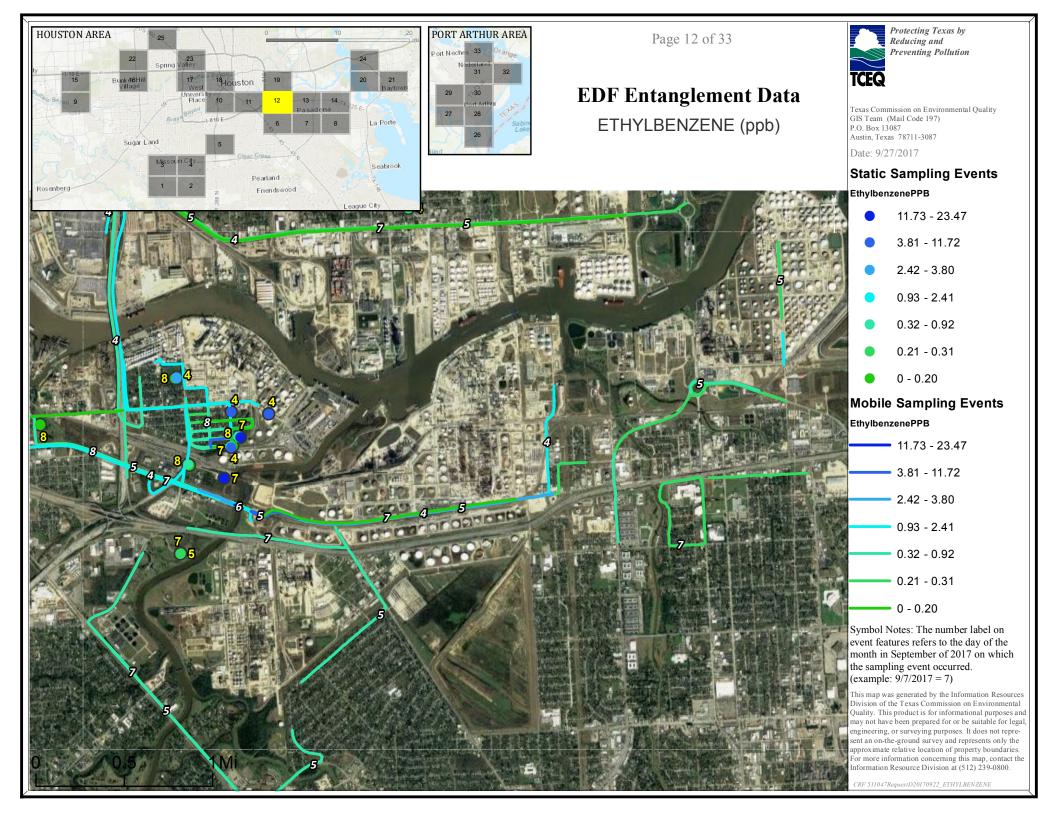
This map was generated by the Information Resources Division of the Texas Commission on Environmental Quality. This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. It does not represent an on-the-ground survey and represents only the approximate relative location of property boundaries. For more information conceming this map, contact the Information Resource Division at (512) 239-0800.

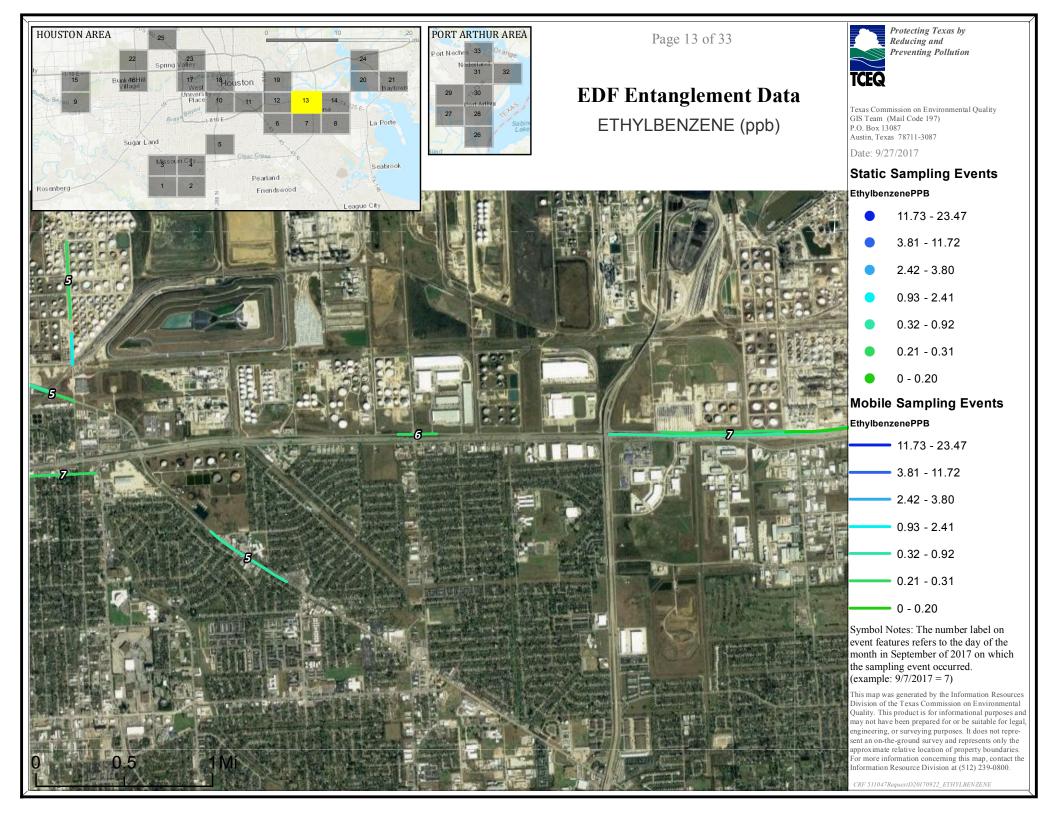
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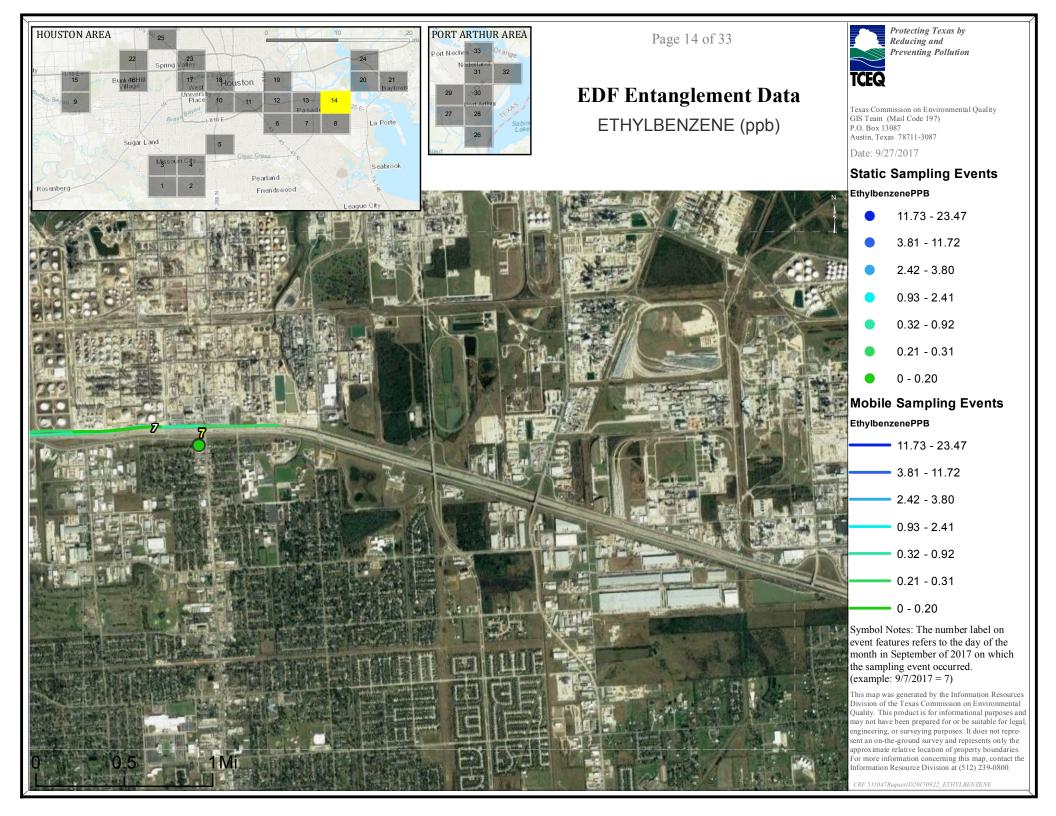


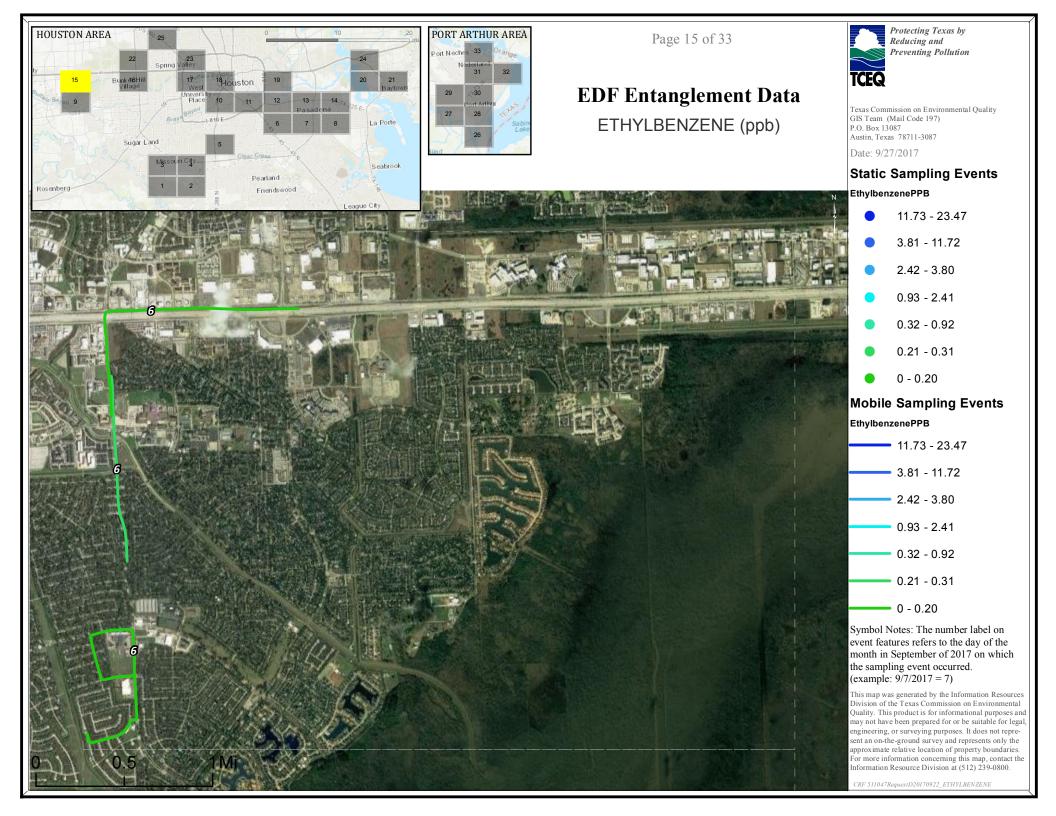


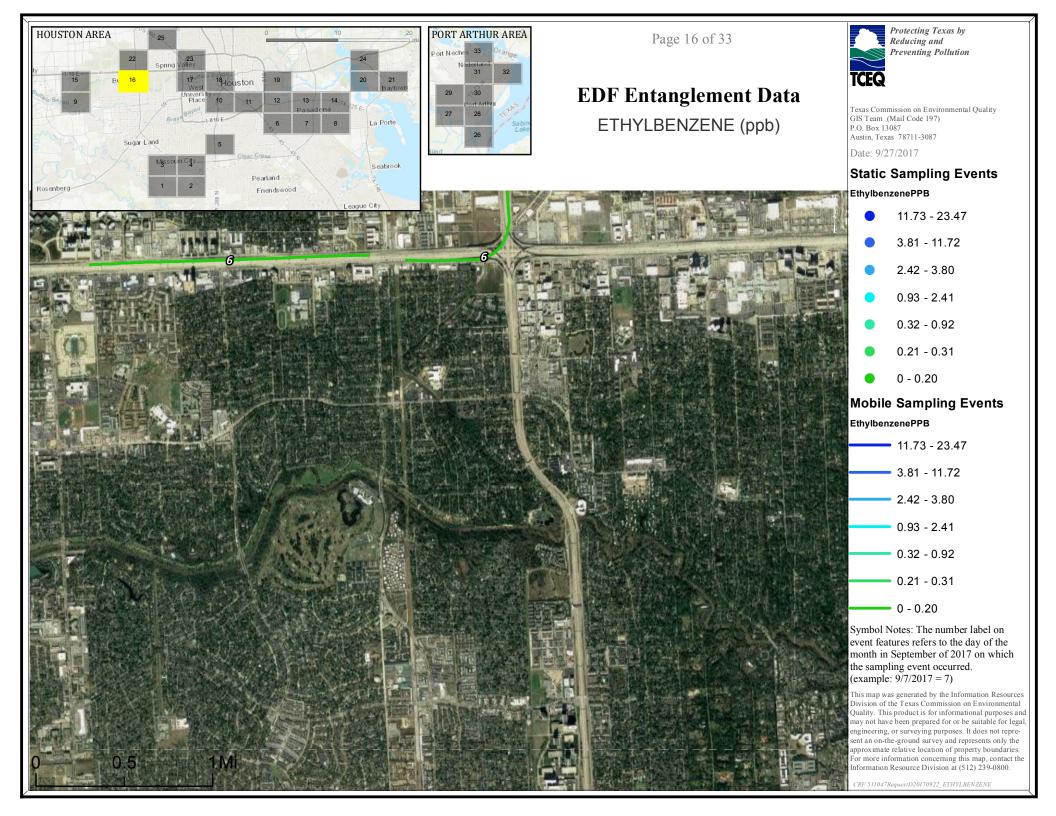


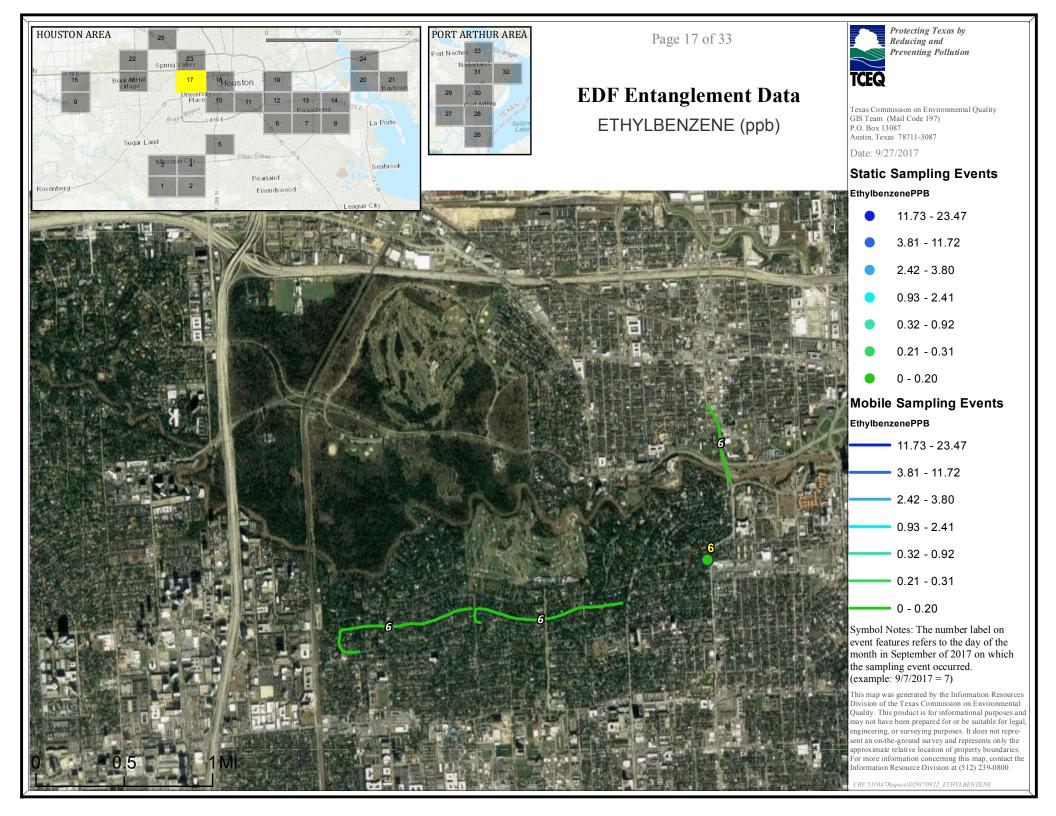


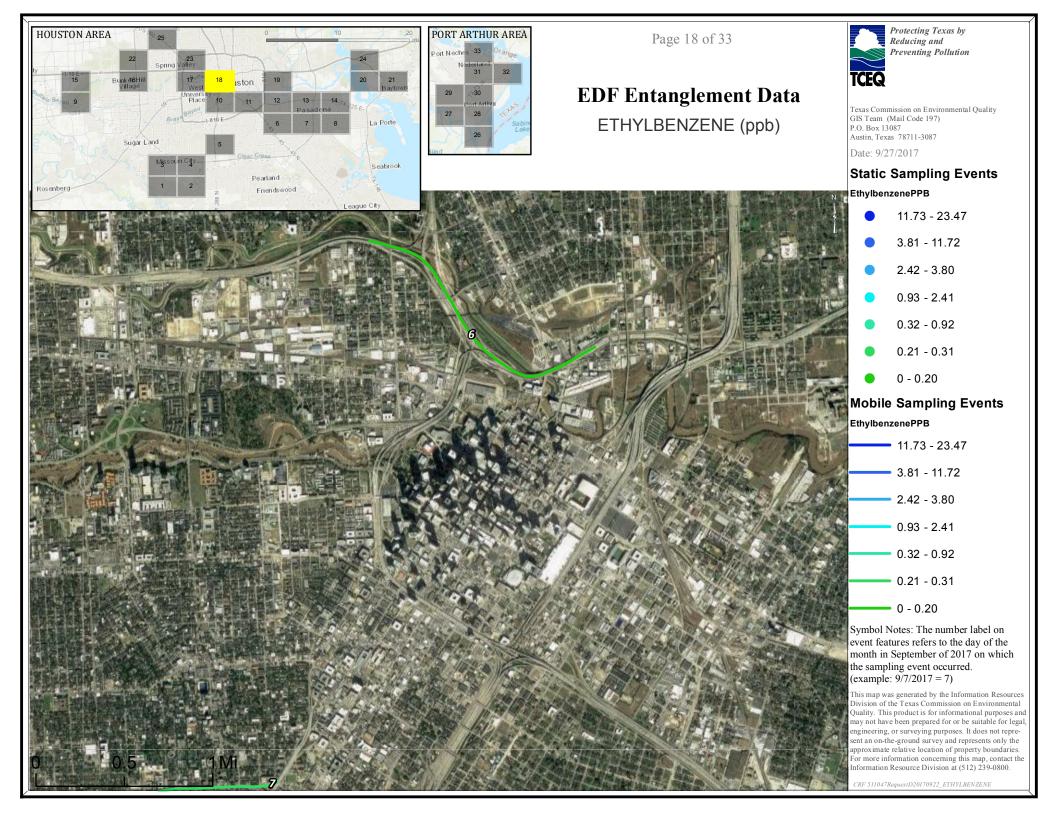


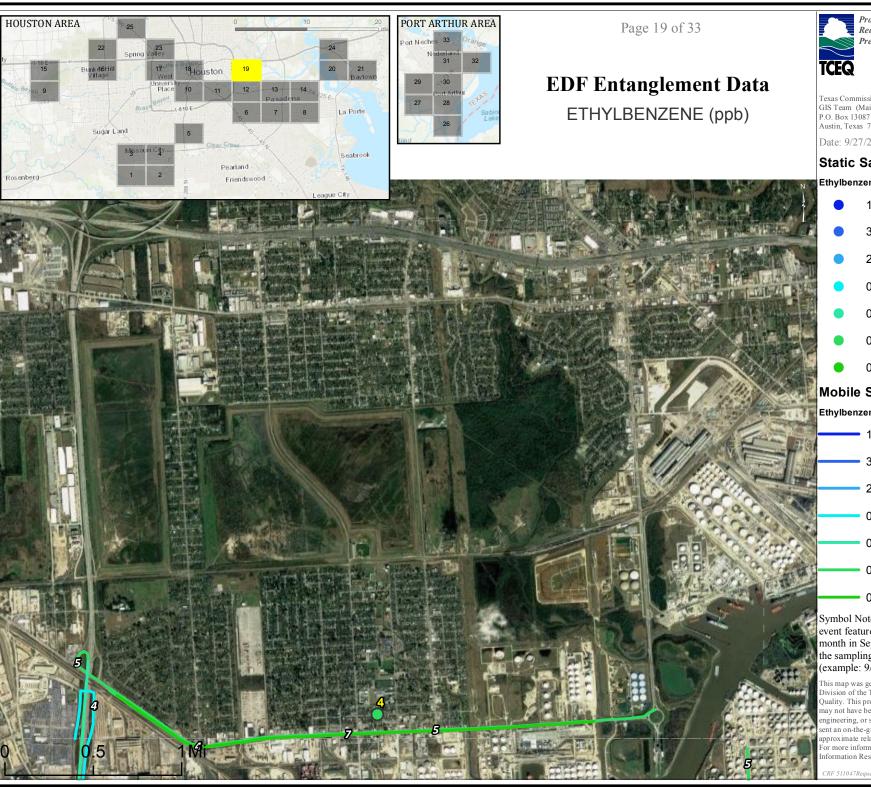












Protecting Texas by Reducing and

Preventing Pollution

Texas Commission on Environmental Quality GIS Team (Mail Code 197) Austin, Texas 78711-3087

Date: 9/27/2017

Static Sampling Events

EthylbenzenePPB

- 11.73 23.47
- 3.81 11.72
- 2.42 3.80
- 0.93 2.41
- 0.32 0.92
- 0.21 0.31
- 0 0.20

Mobile Sampling Events

EthylbenzenePPB

11.73 - 23.47

3.81 - 11.72

2.42 - 3.80

0.93 - 2.41

0.32 - 0.92

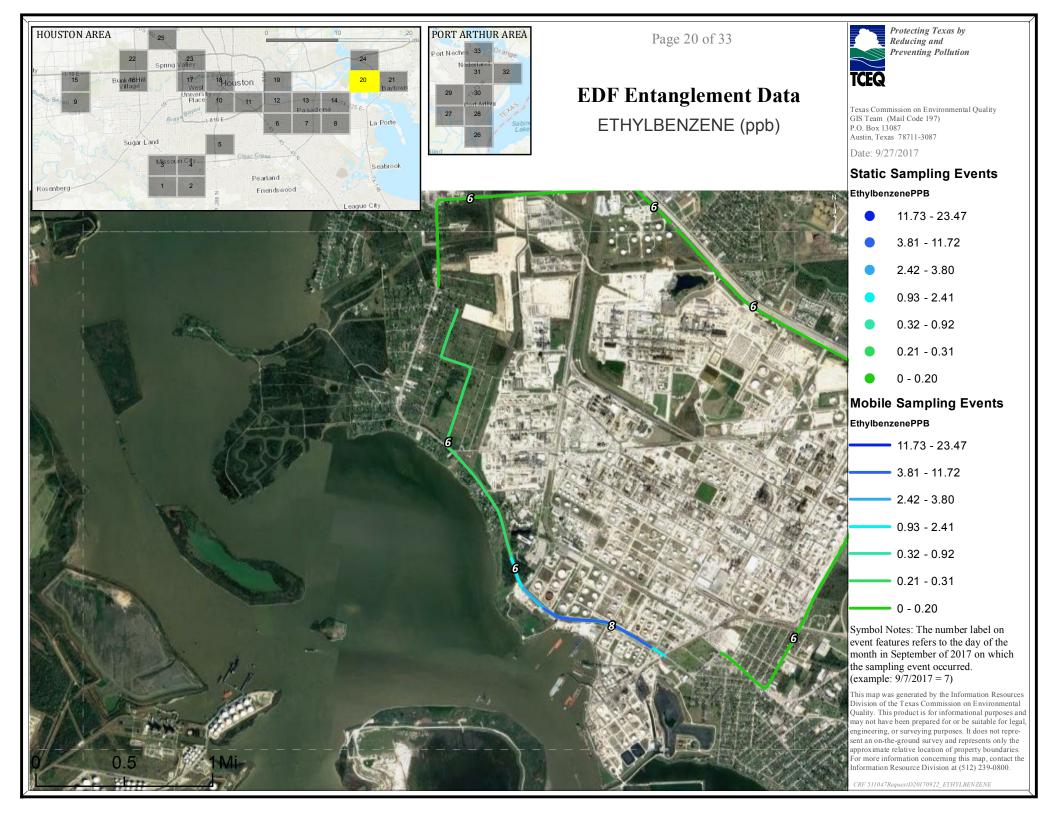
0.21 - 0.31

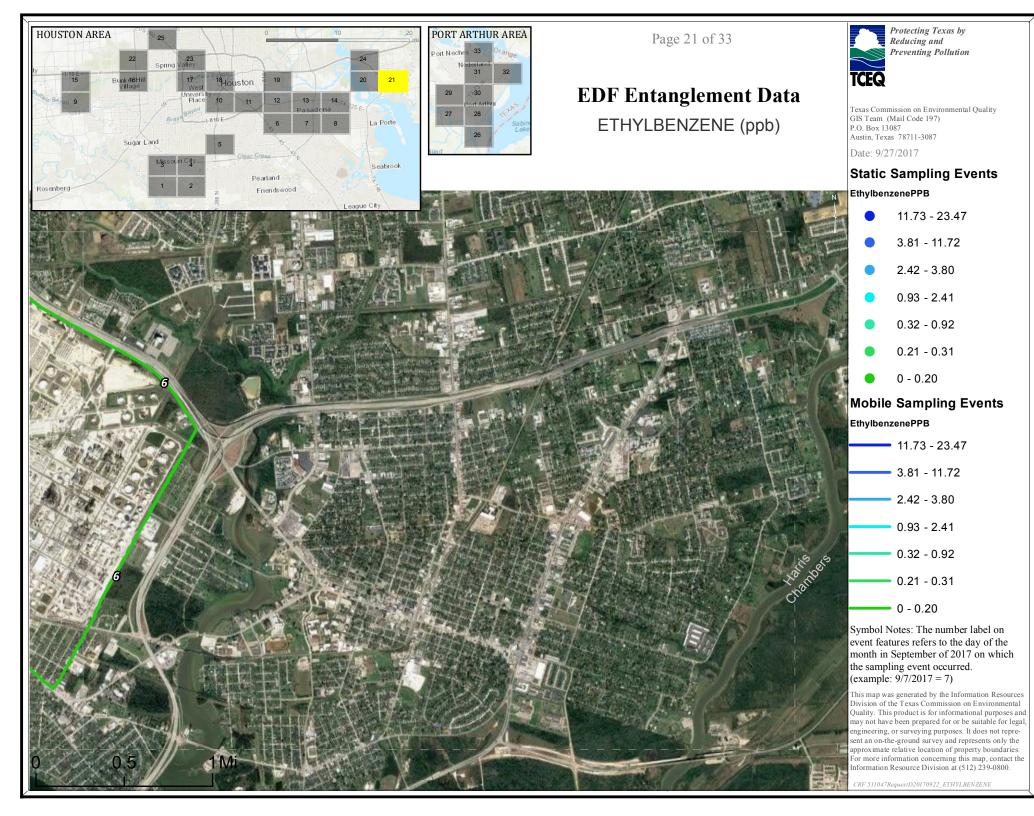
0 - 0.20

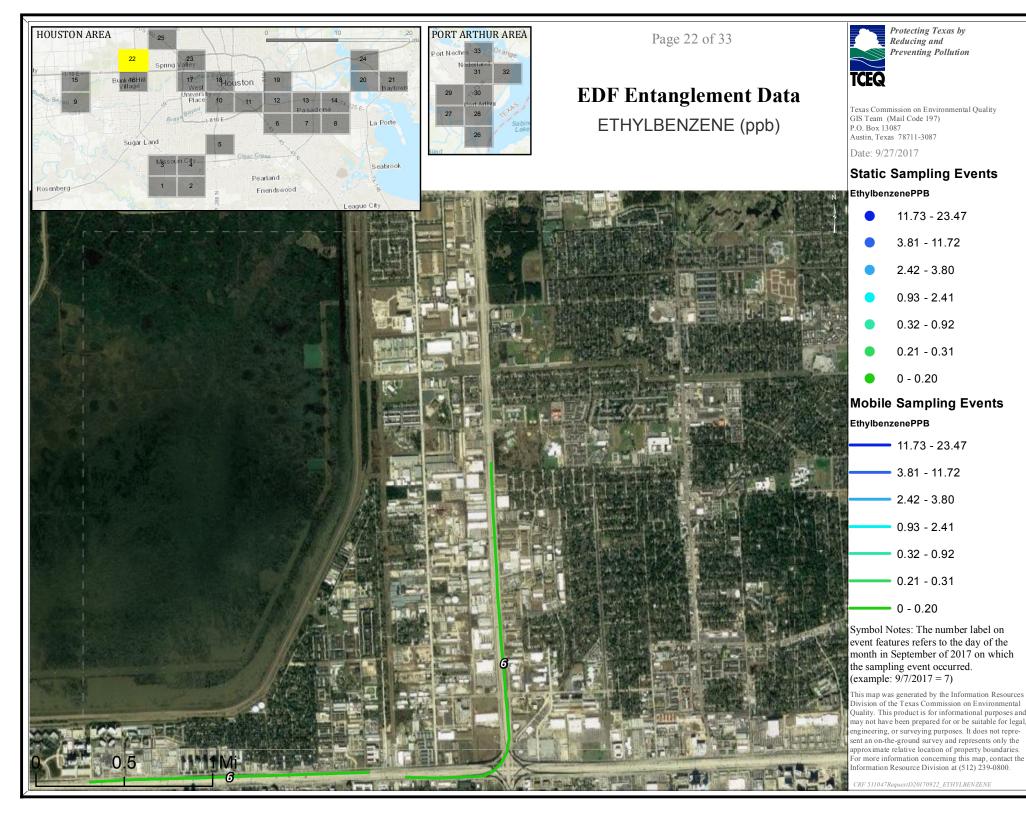
Symbol Notes: The number label on event features refers to the day of the month in September of 2017 on which the sampling event occurred. (example: 9/7/2017 = 7)

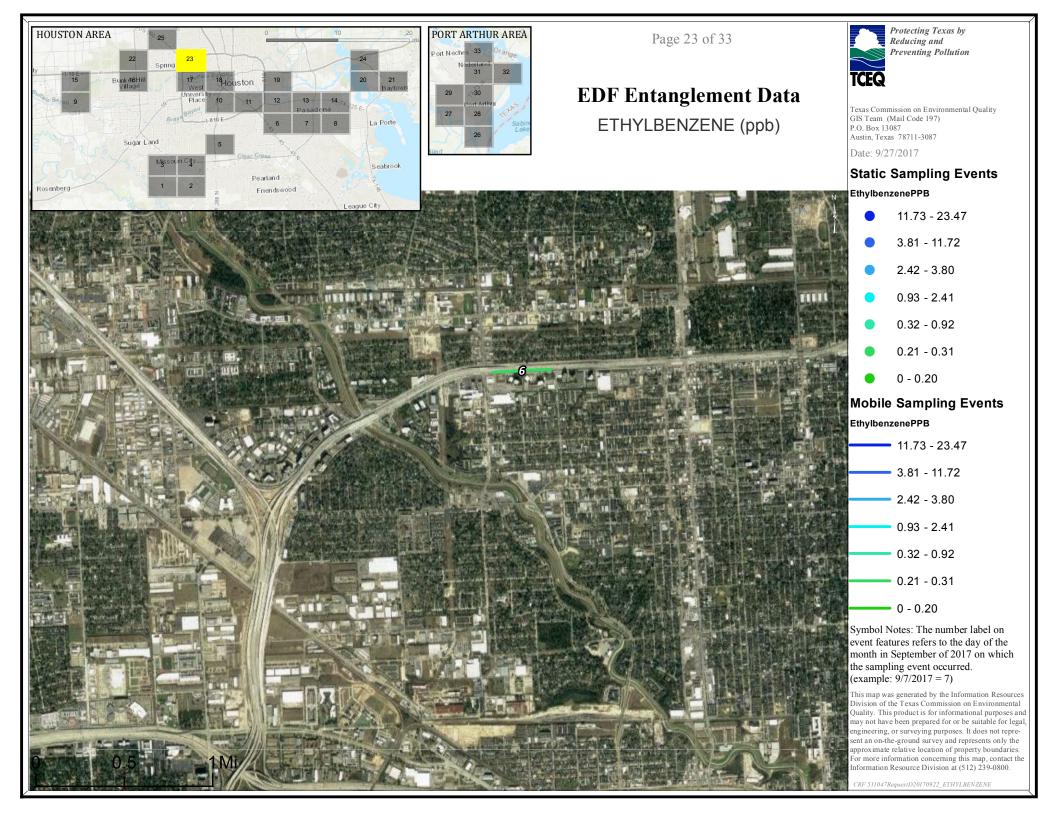
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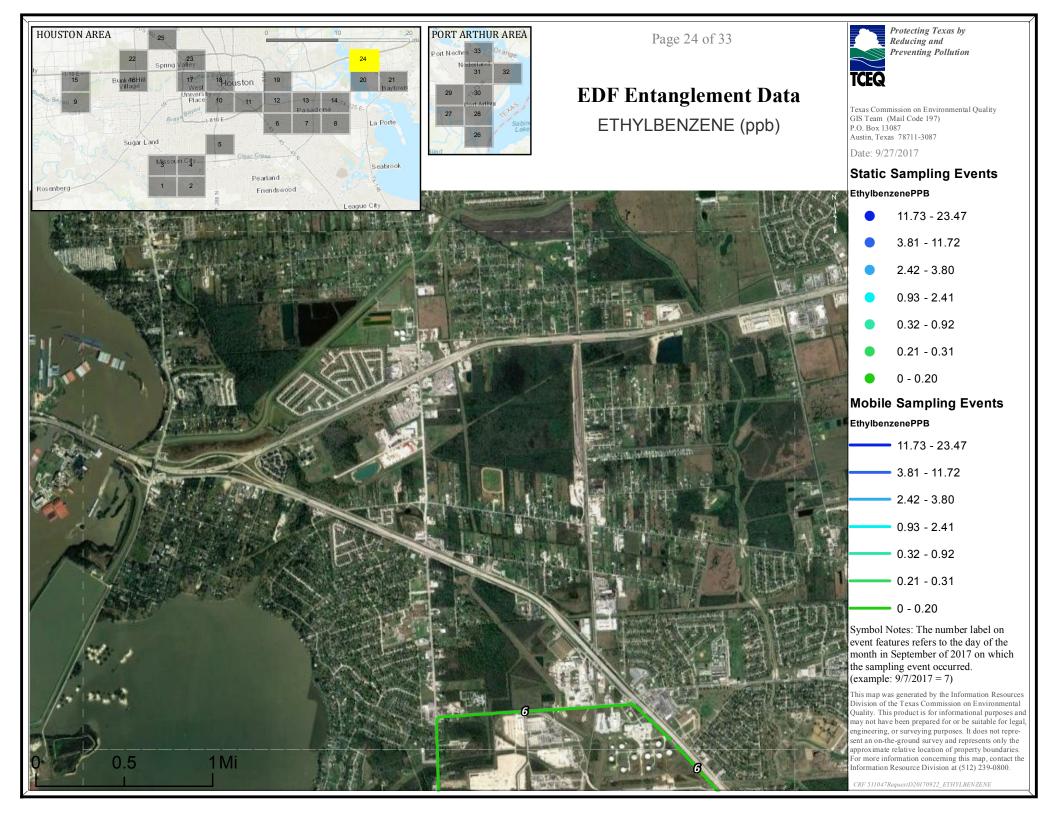
CRF 511047RequestD20170922_ETHYLBENZENE

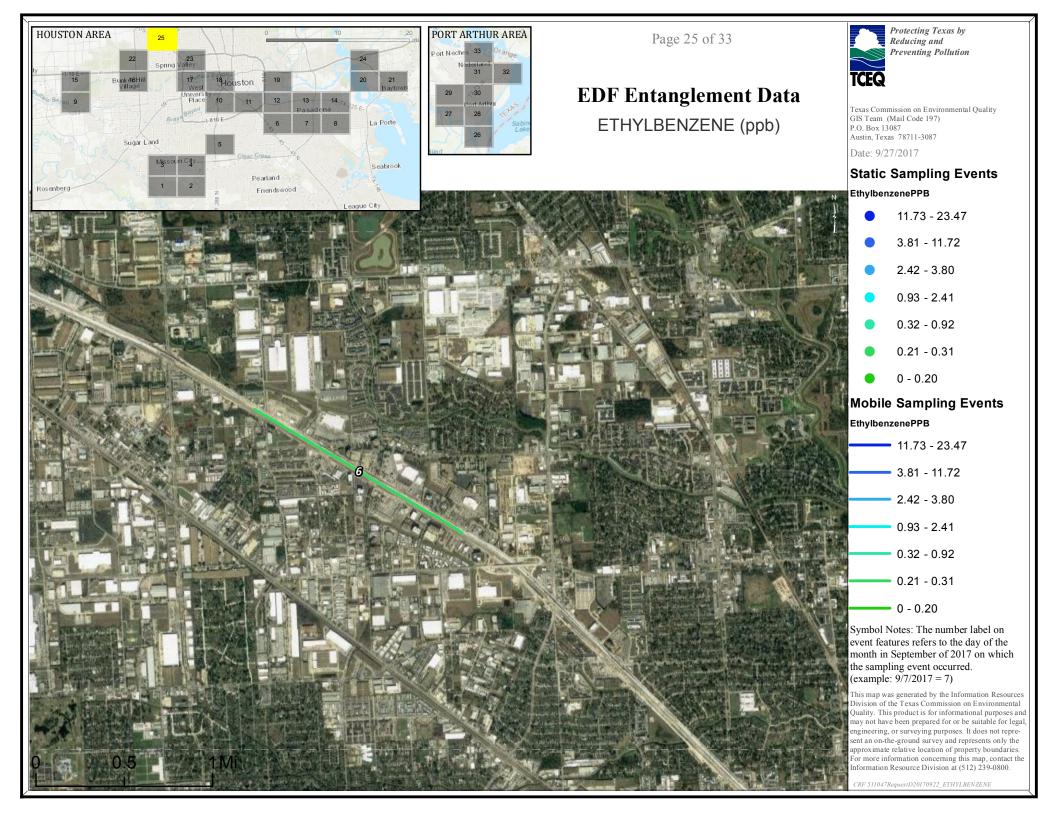




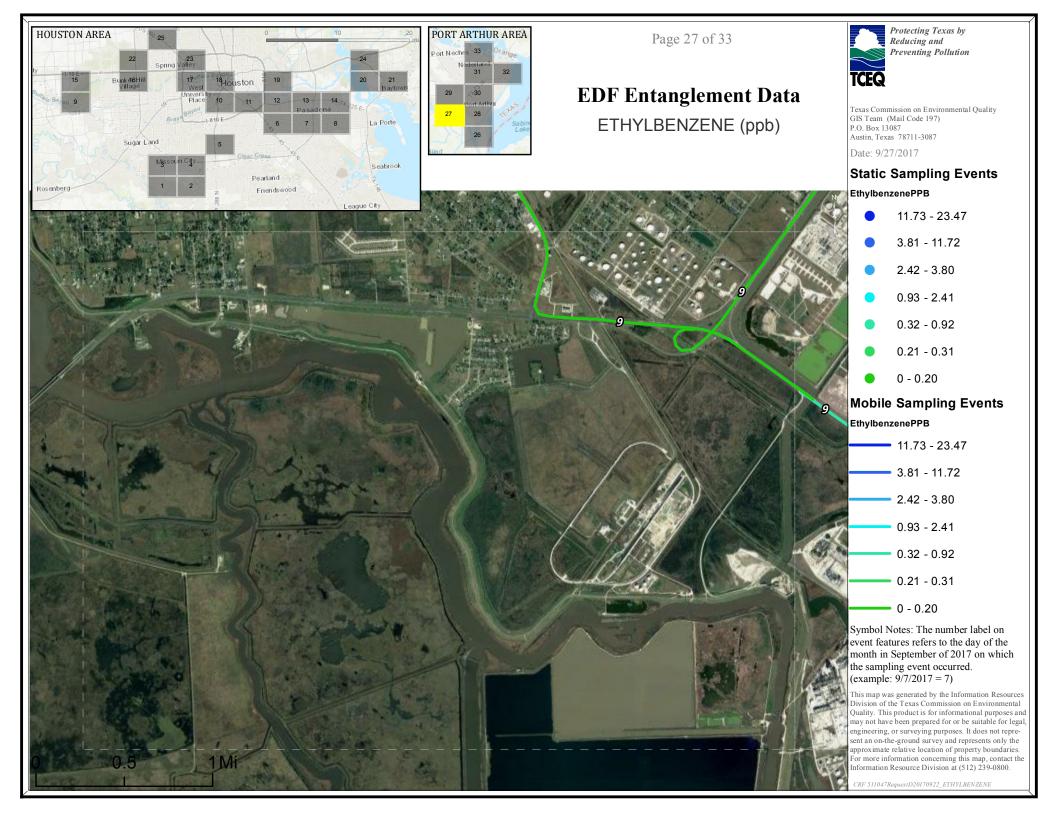


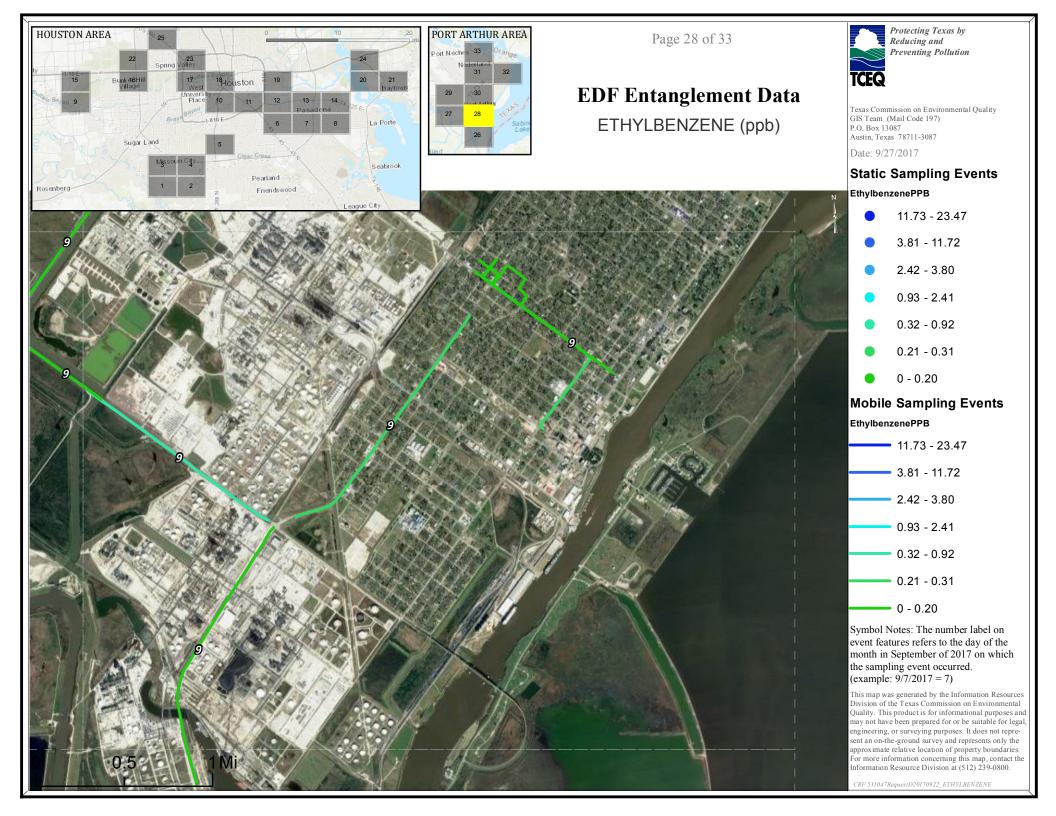


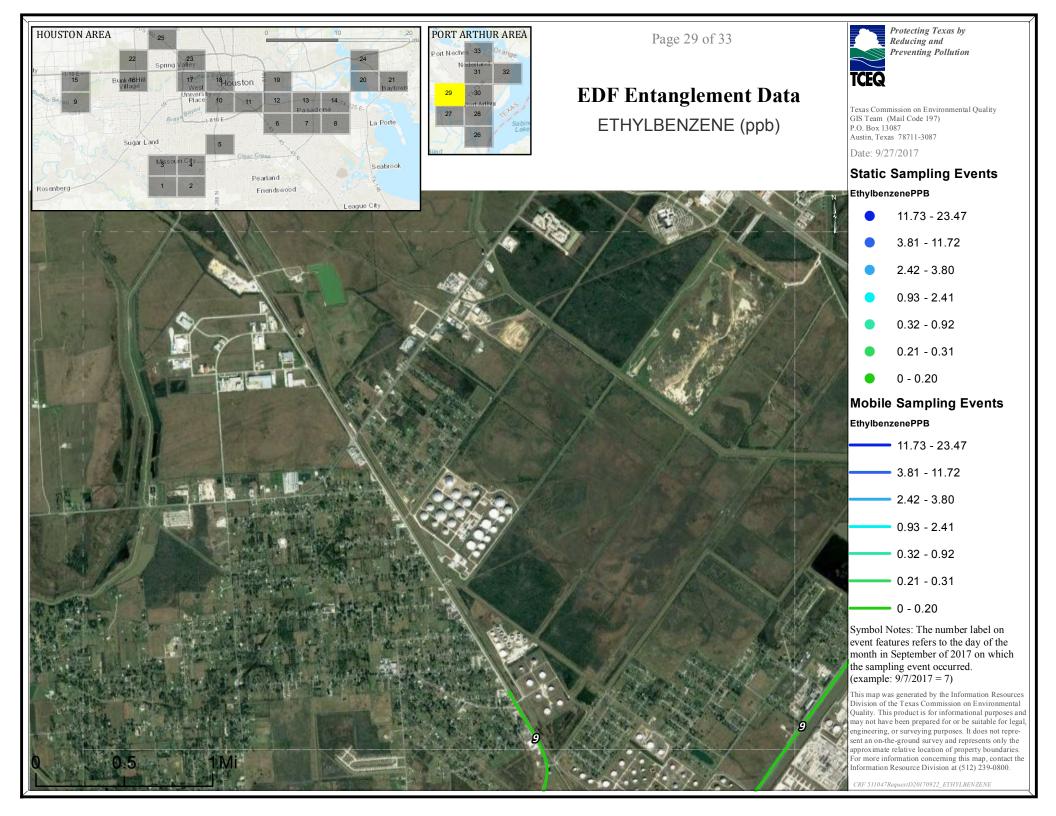


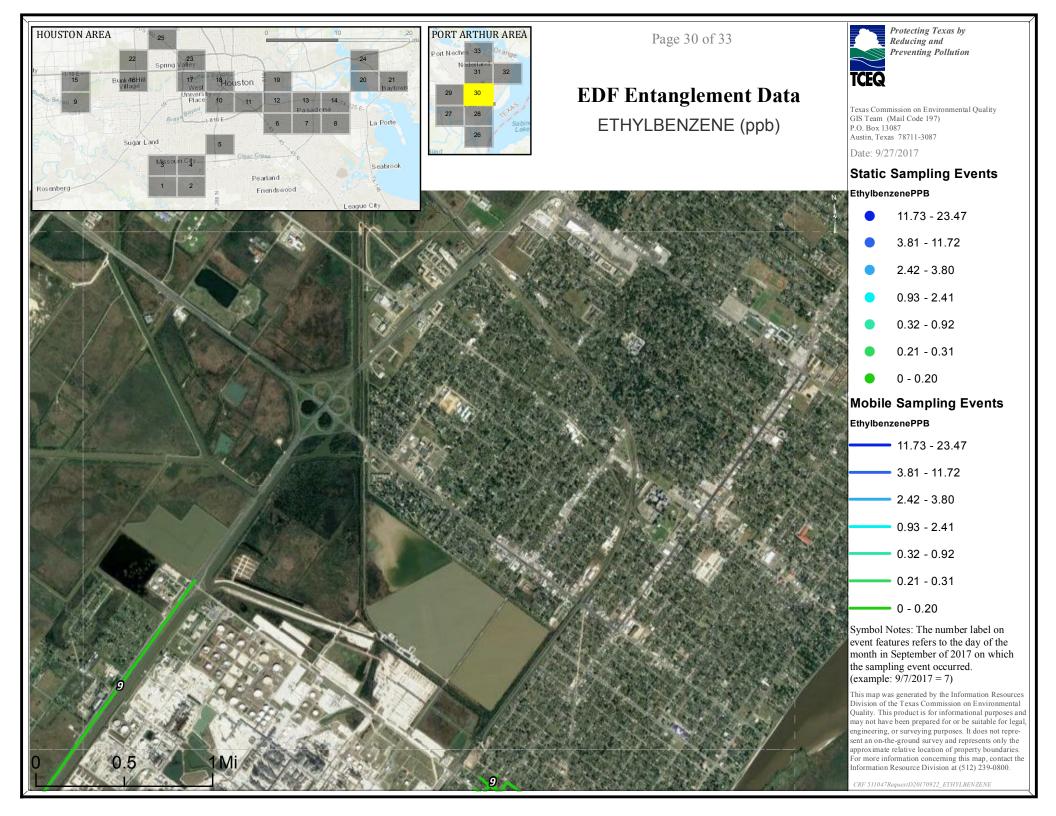


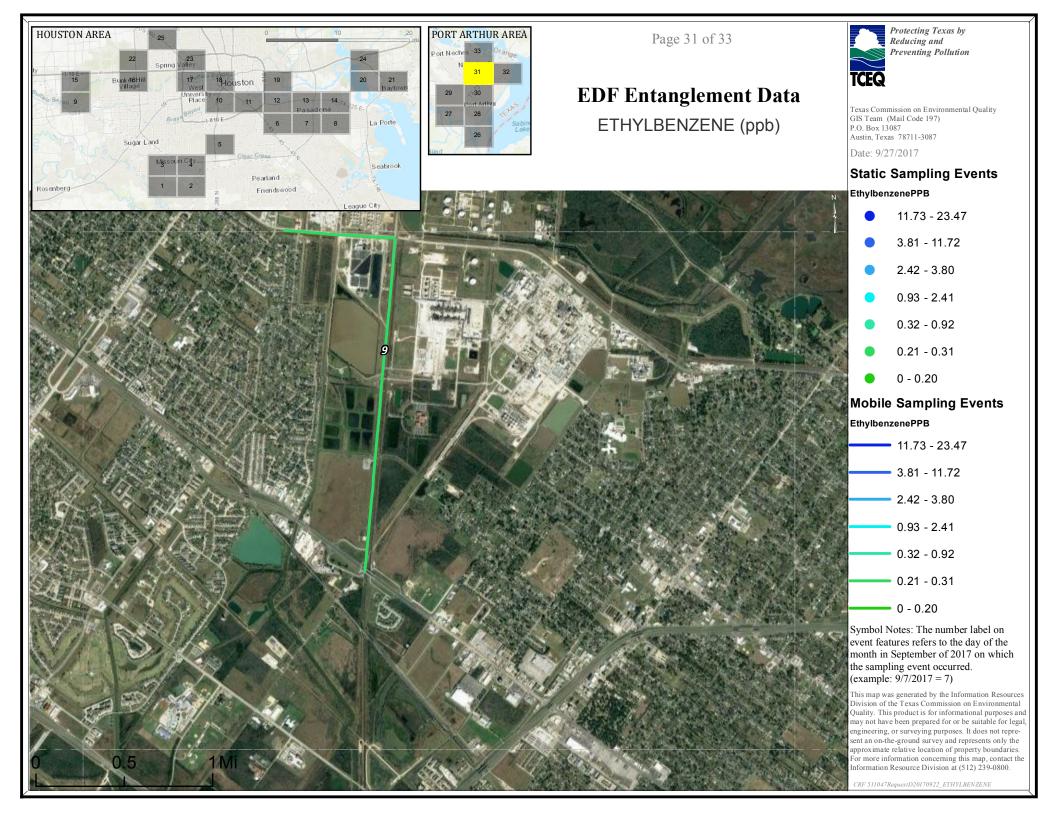


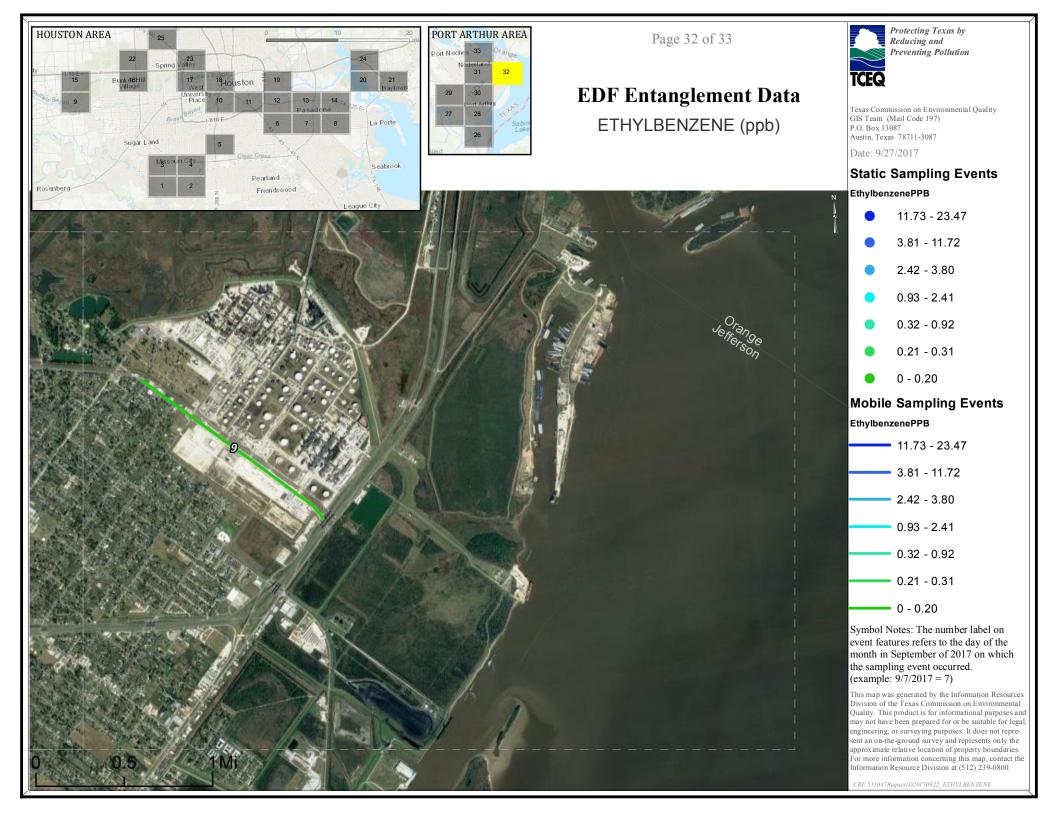


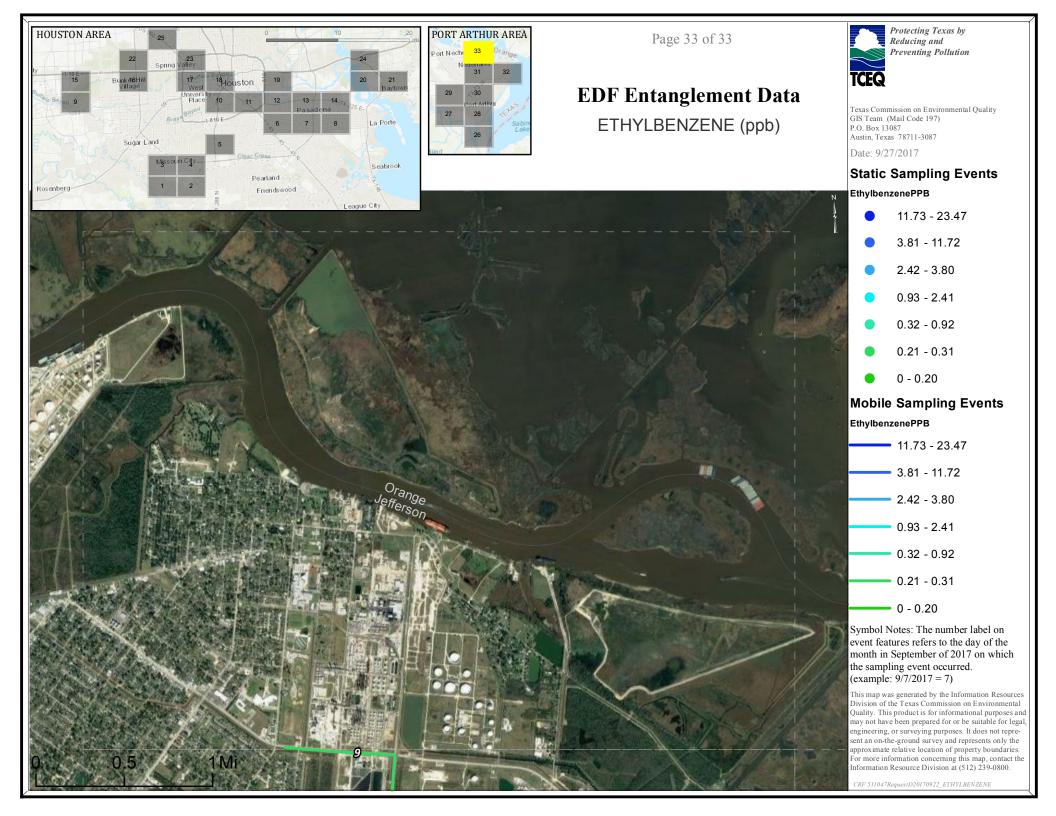


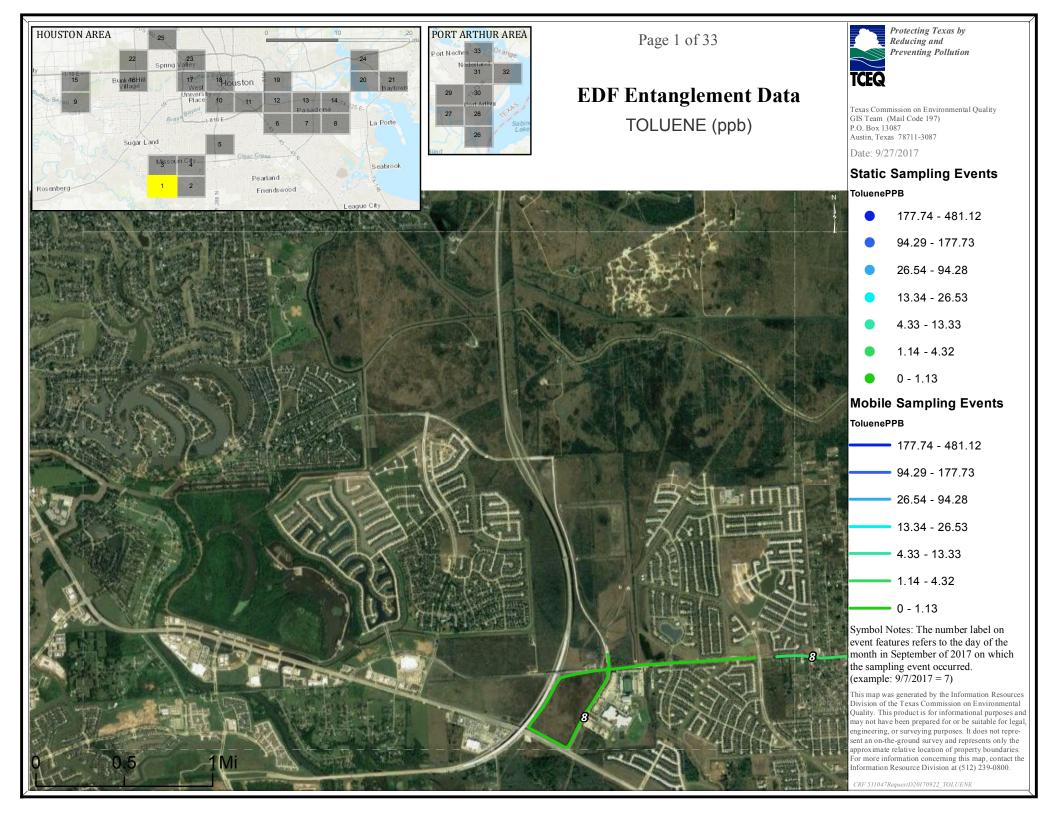


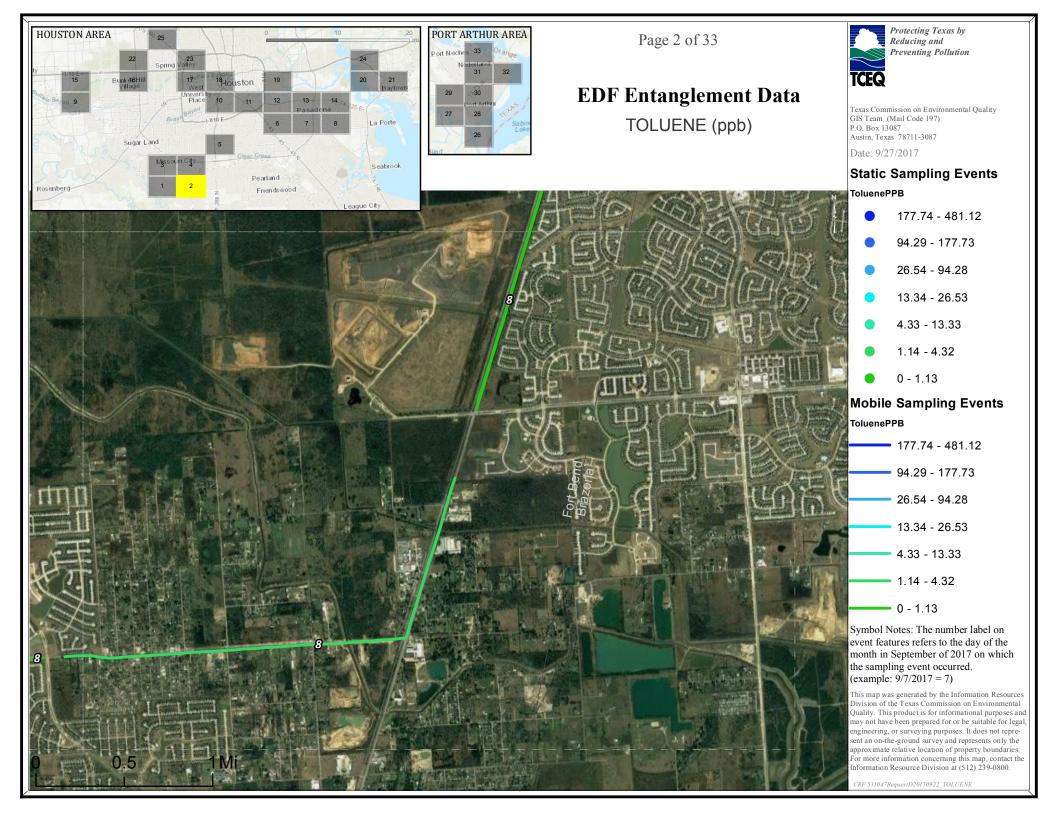


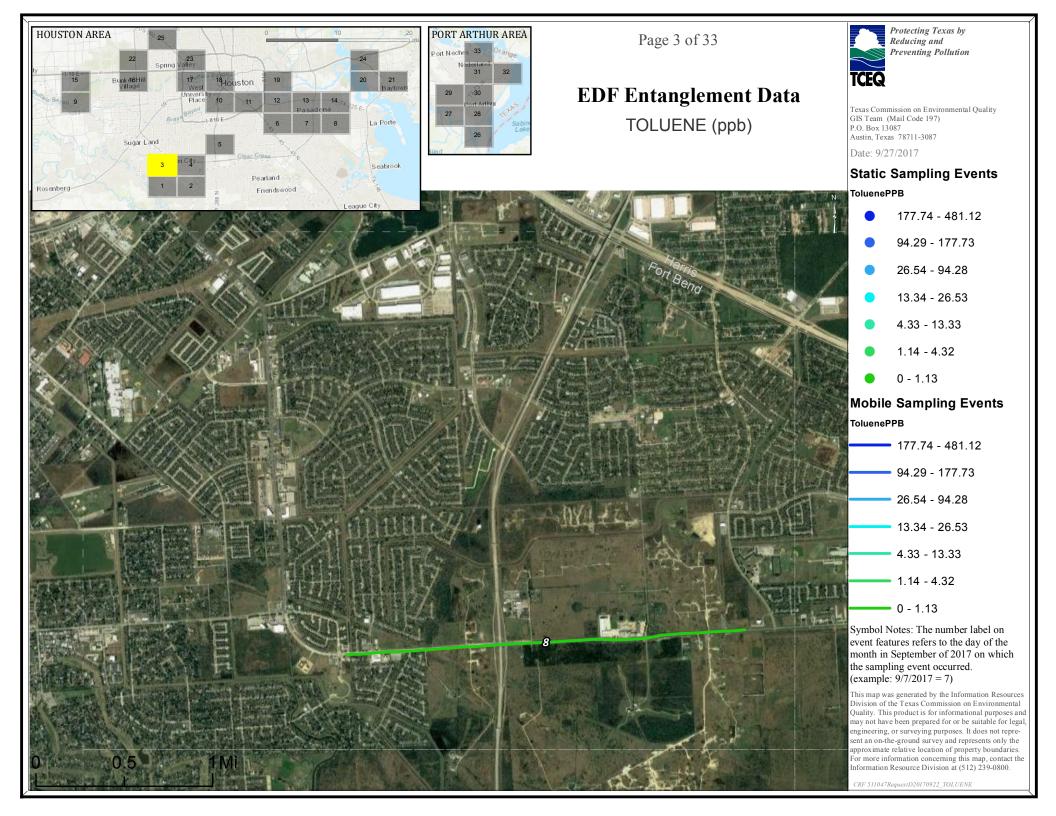


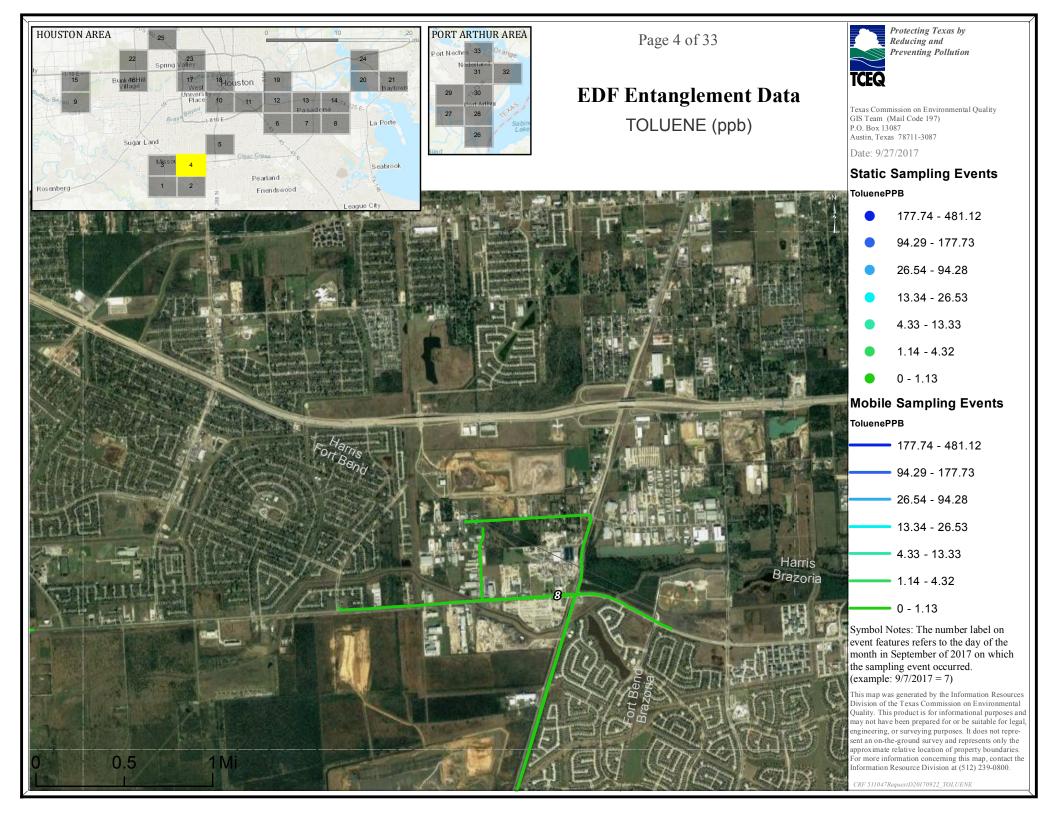


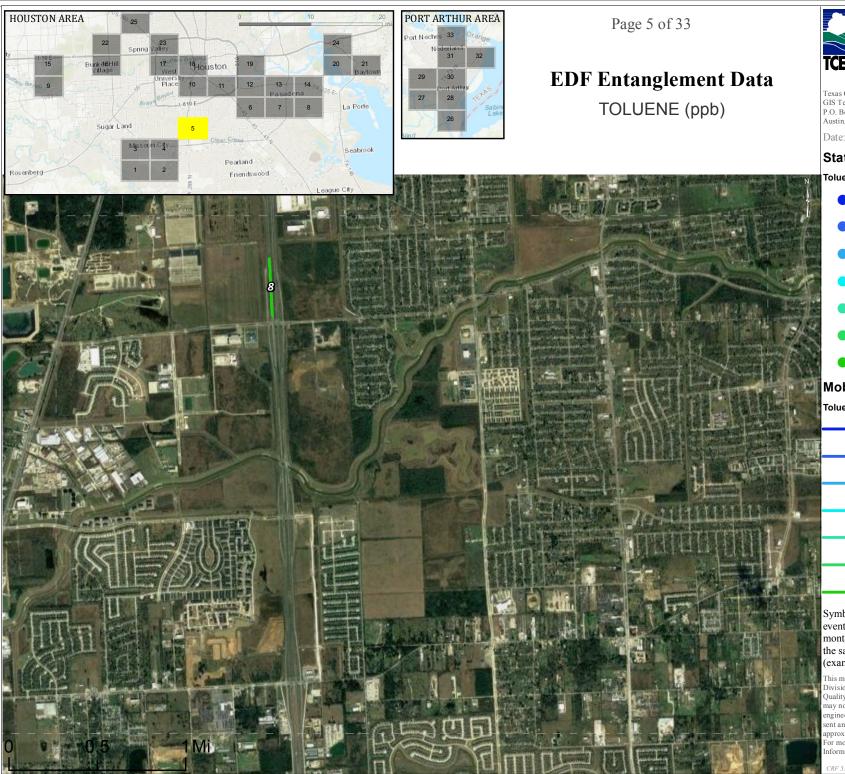














Protecting Texas by Reducing and Preventing Pollution

Texas Commission on Environmental Quality GIS Team (Mail Code 197) P.O. Box 13087 Austin, Texas 78711-3087

Date: 9/27/2017

Static Sampling Events

- 177.74 481.12
- 94.29 177.73
- 26.54 94.28
- 13.34 26.53
- 4.33 13.33
- 1.14 4.32
- 0 1.13

Mobile Sampling Events

ToluenePPB

177.74 - 481.12

94.29 - 177.73

26.54 - 94.28

13.34 - 26.53

4.33 - 13.33

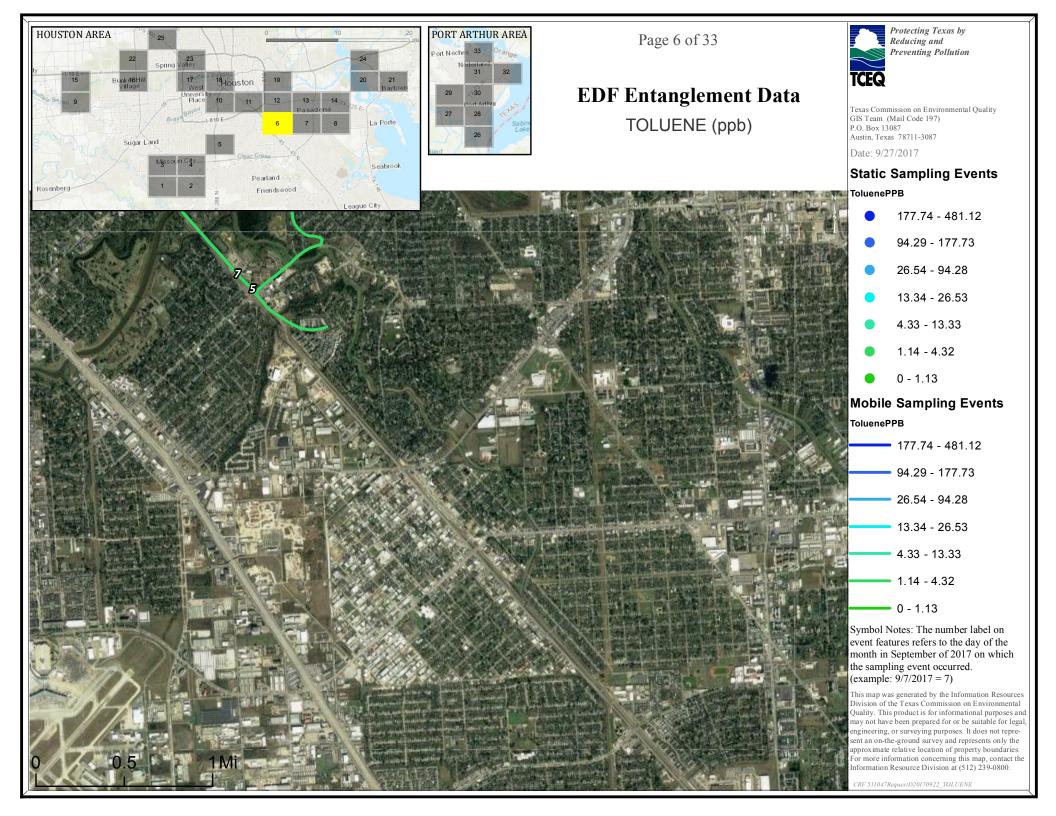
1.14 - 4.32

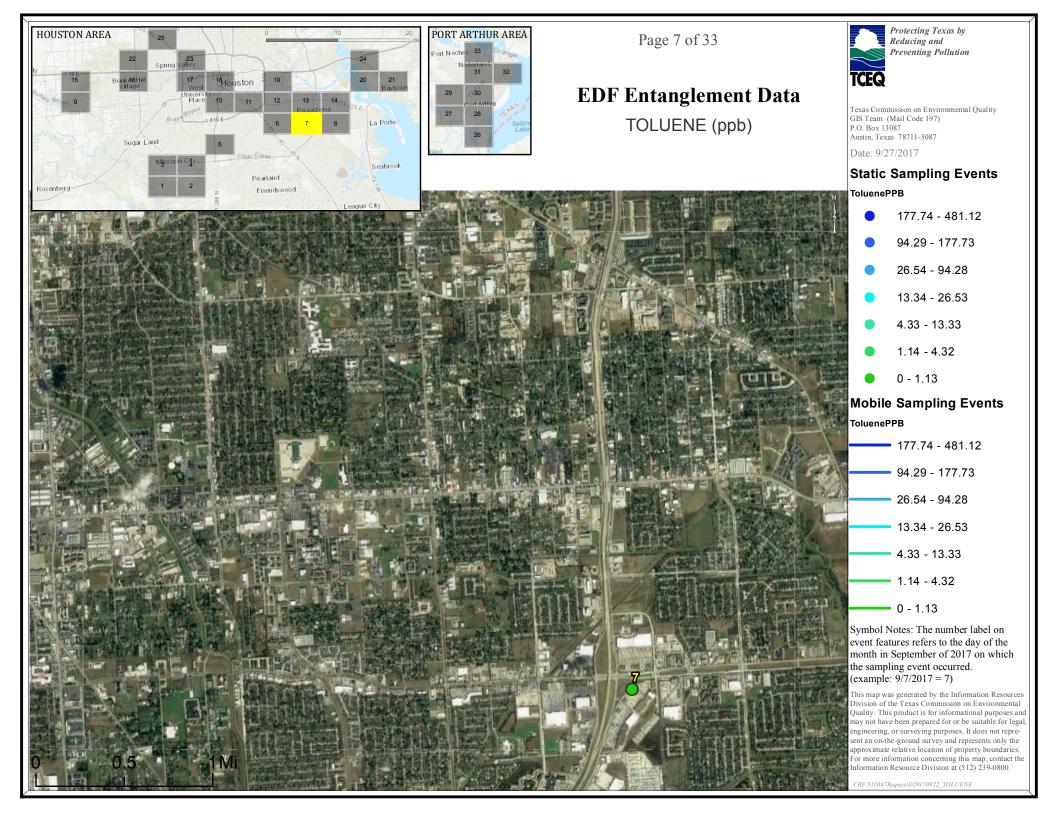
0 - 1.13

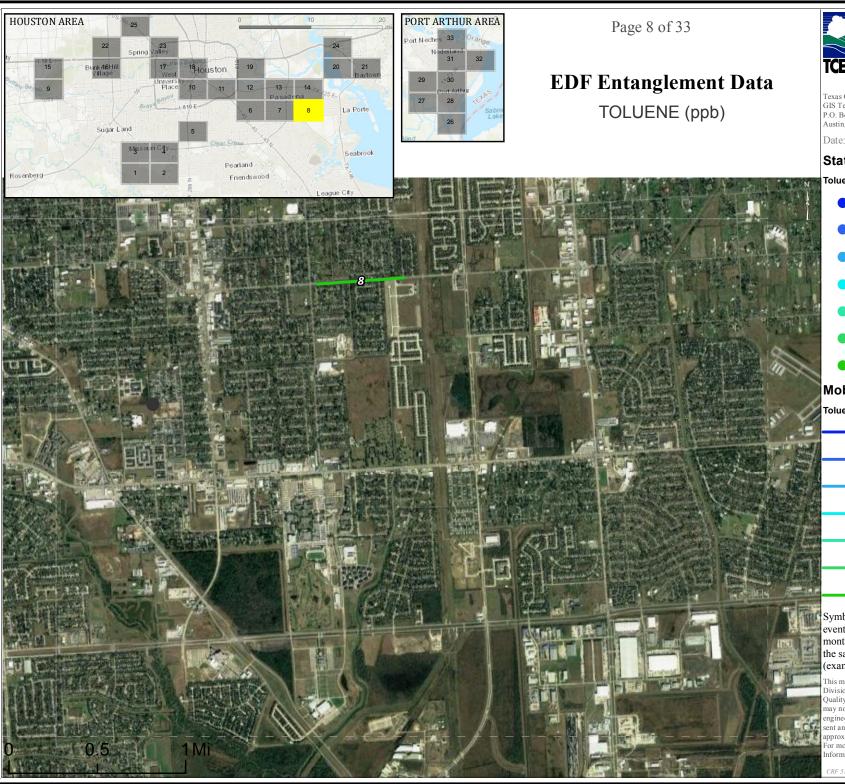
Symbol Notes: The number label on event features refers to the day of the month in September of 2017 on which the sampling event occurred. (example: 9/7/2017 = 7)

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CRF 511047RequestD20170922_TOLUENE







Protecting Texas by Reducing and

Preventing Pollution

Texas Commission on Environmental Quality GIS Team (Mail Code 197) P.O. Box 13087 Austin, Texas 78711-3087

Date: 9/27/2017

Static Sampling Events

ToluenePPB

- 177.74 481.12
- 94.29 177.73
- 26.54 94.28
- 13.34 26.53
- 4.33 13.33
- 1.14 4.32
- 0 1.13

Mobile Sampling Events

ToluenePPB

177.74 - 481.12

94.29 - 177.73

26.54 - 94.28

13.34 - 26.53

4.33 - 13.33

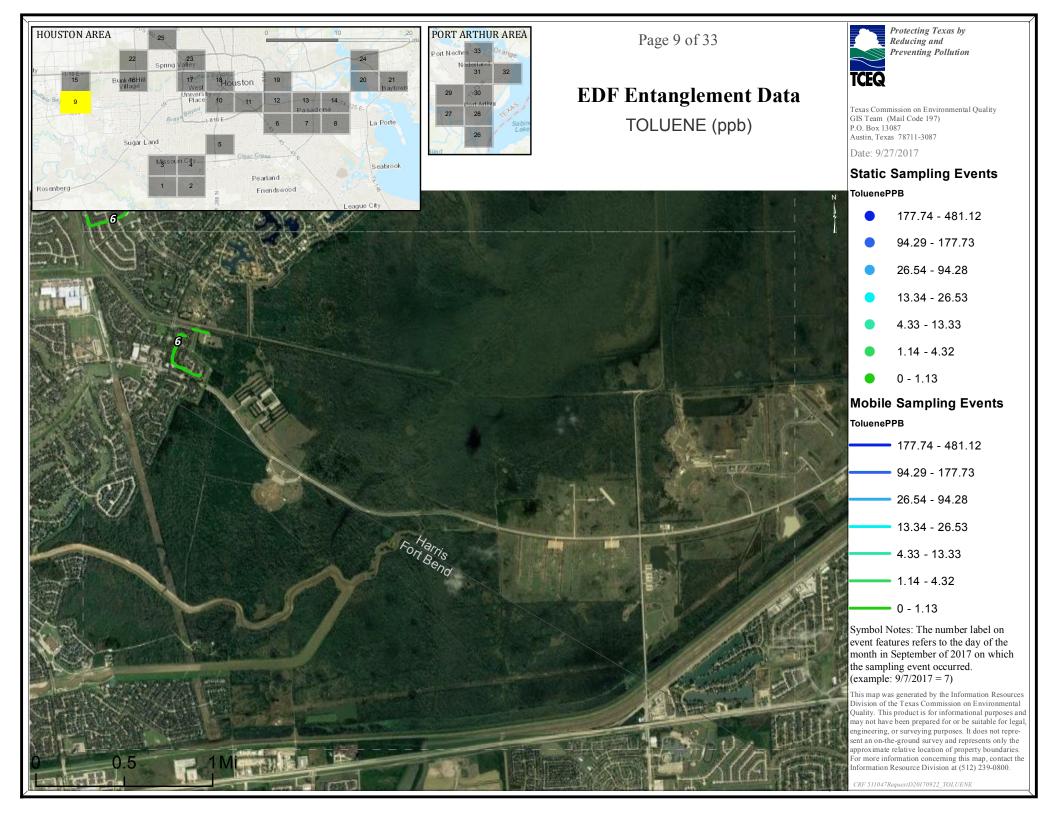
1.14 - 4.32

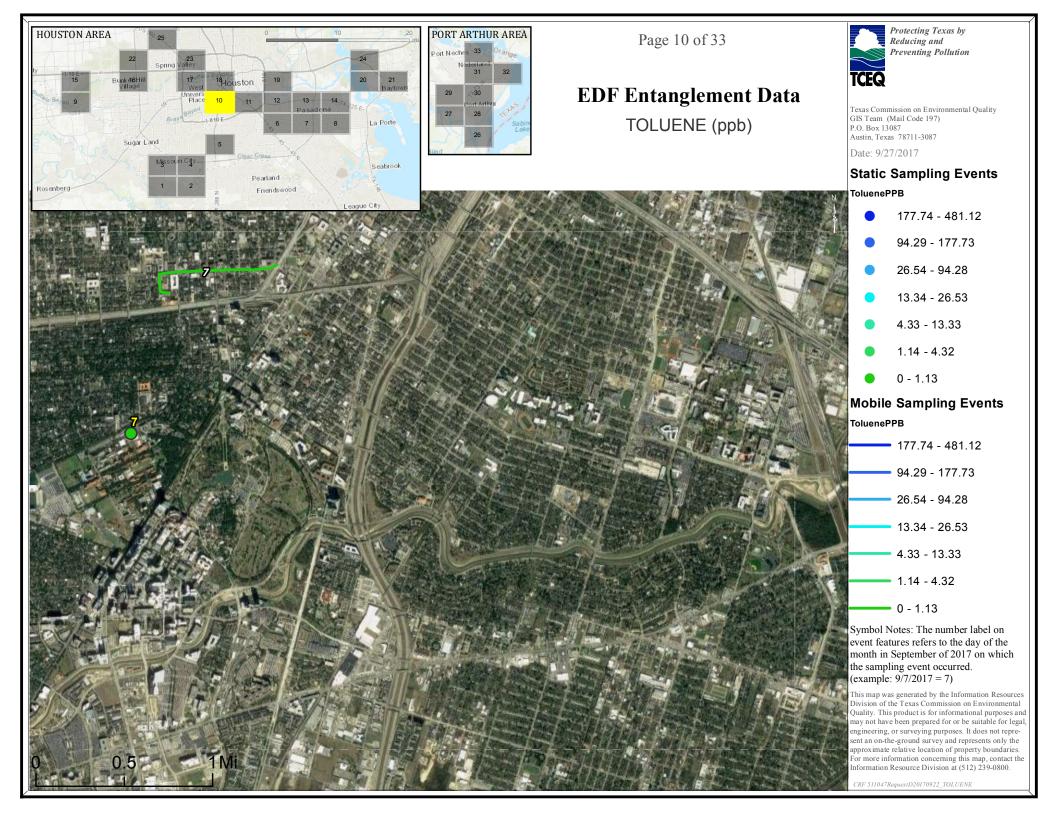
0 - 1.13

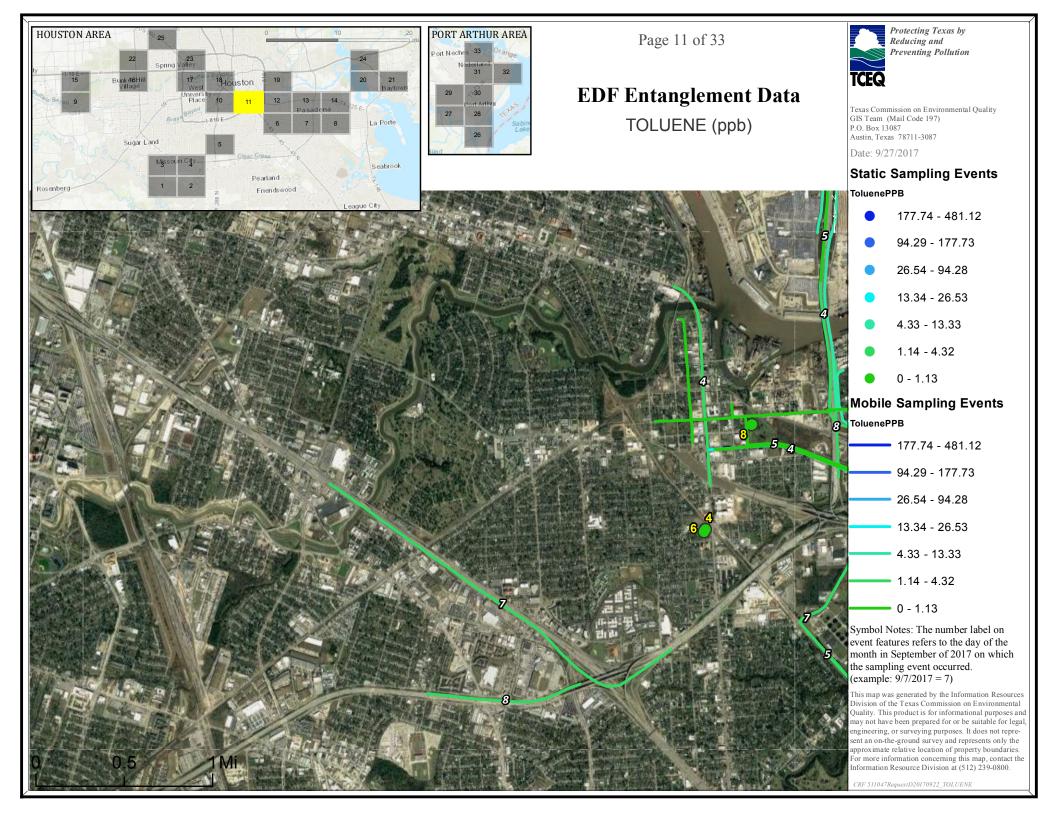
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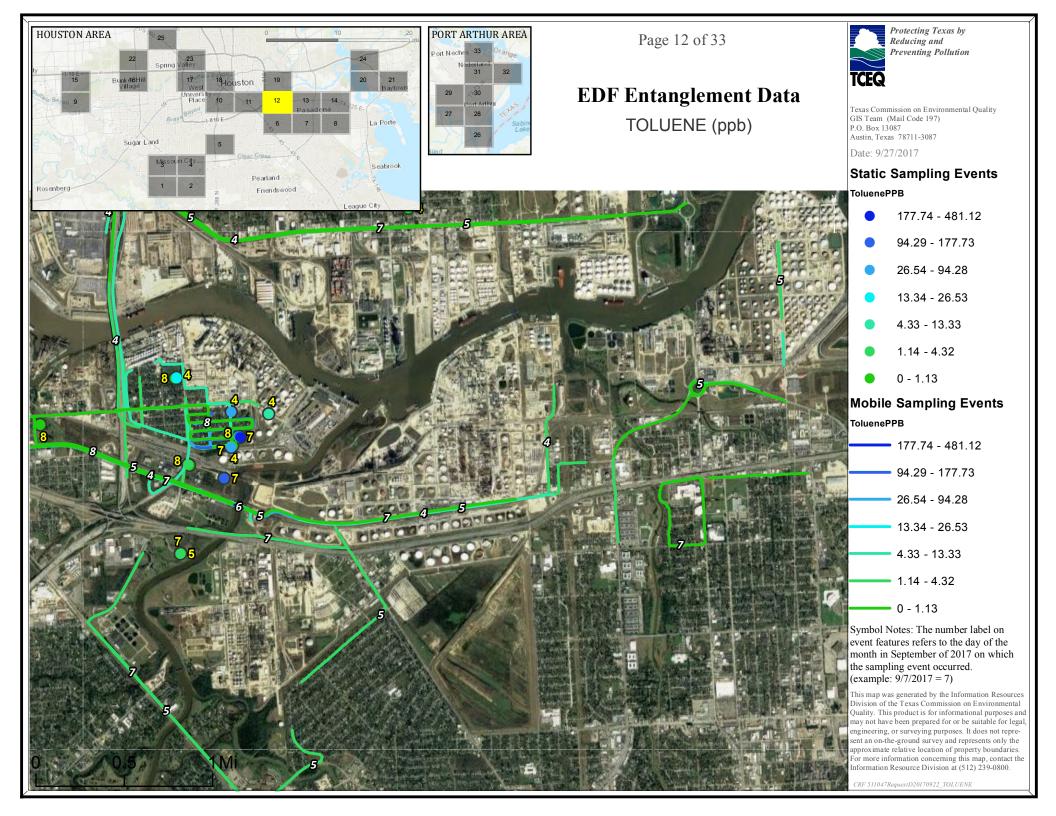
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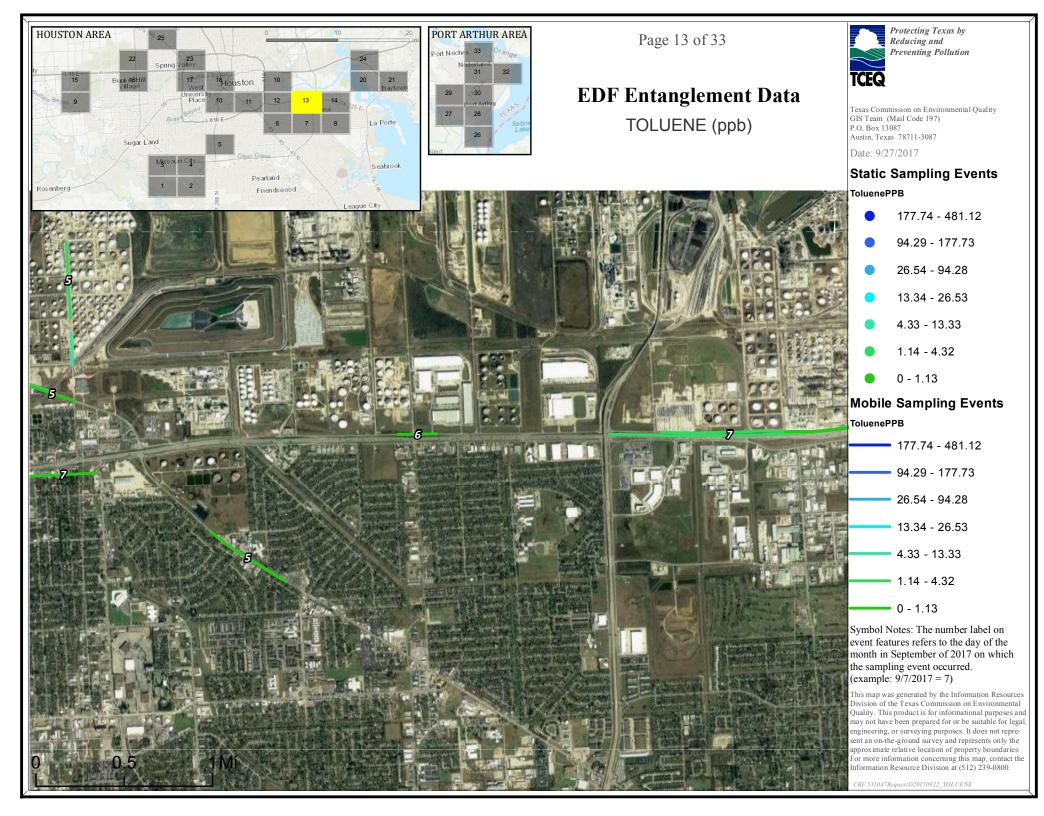
CRF 511047RequestD20170922_TOLUENE

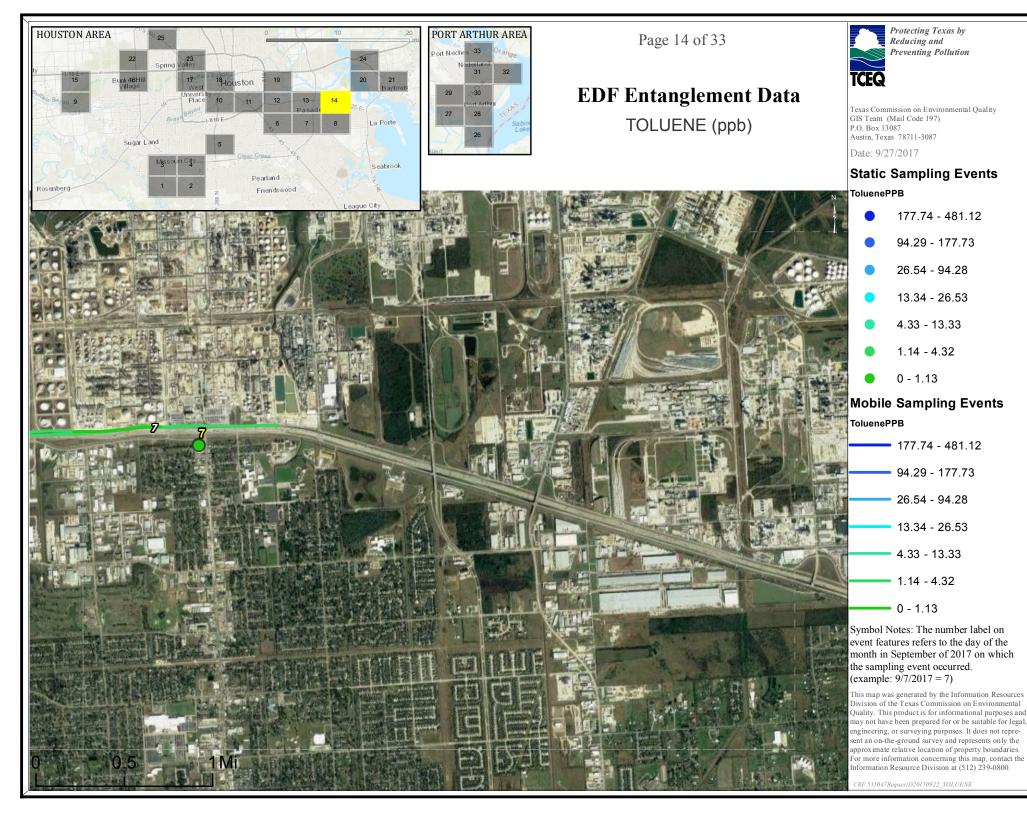


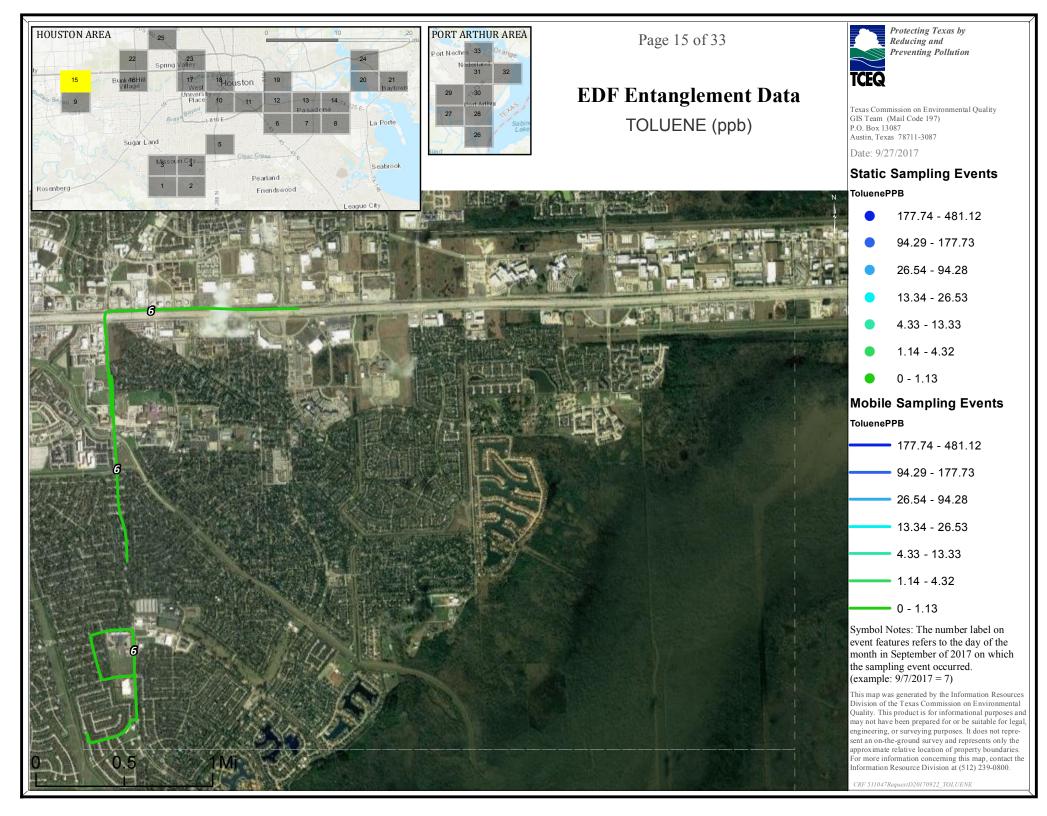


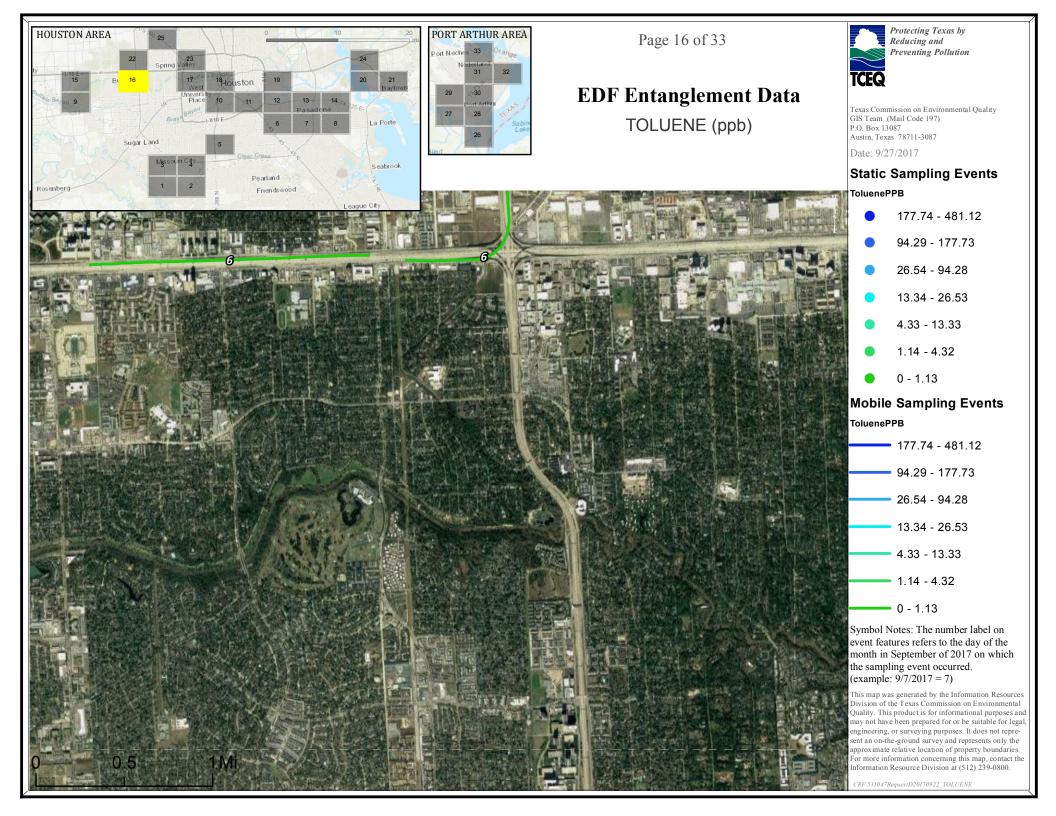


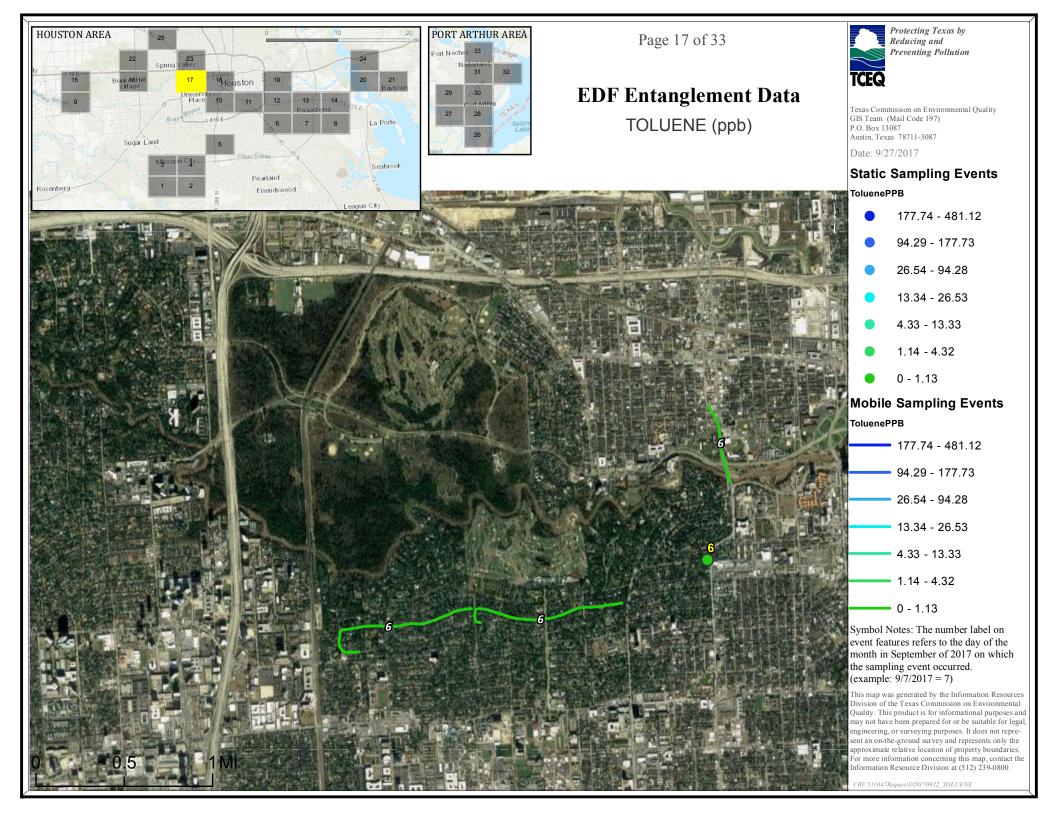


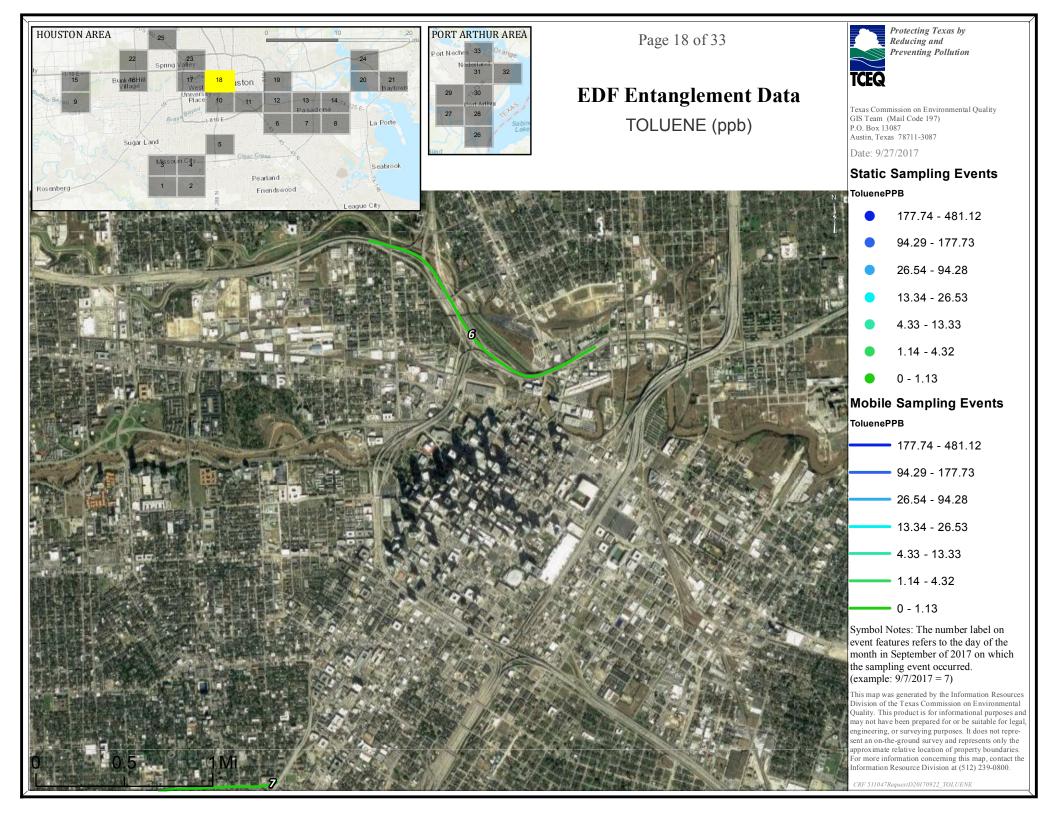


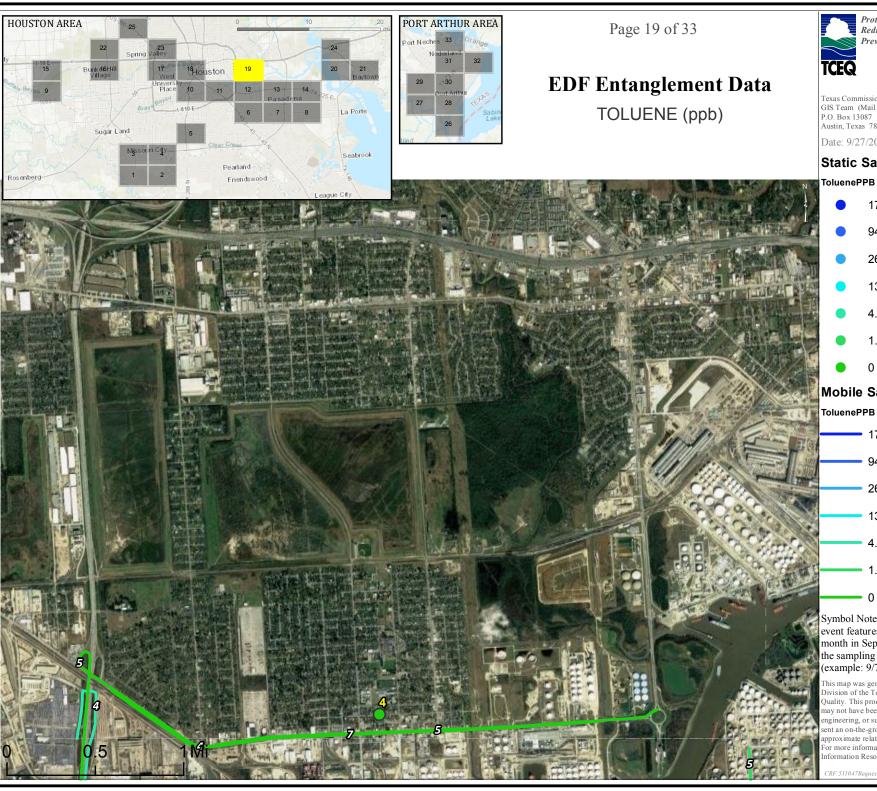














Protecting Texas by Reducing and Preventing Pollution

Texas Commission on Environmental Quality GIS Team (Mail Code 197) P.O. Box 13087 Austin, Texas 78711-3087

Date: 9/27/2017

Static Sampling Events

- 177.74 481.12
- 94.29 177.73
- 26.54 94.28
- 13.34 26.53
- 4.33 13.33
- 1.14 4.32
- 0 1.13

Mobile Sampling Events

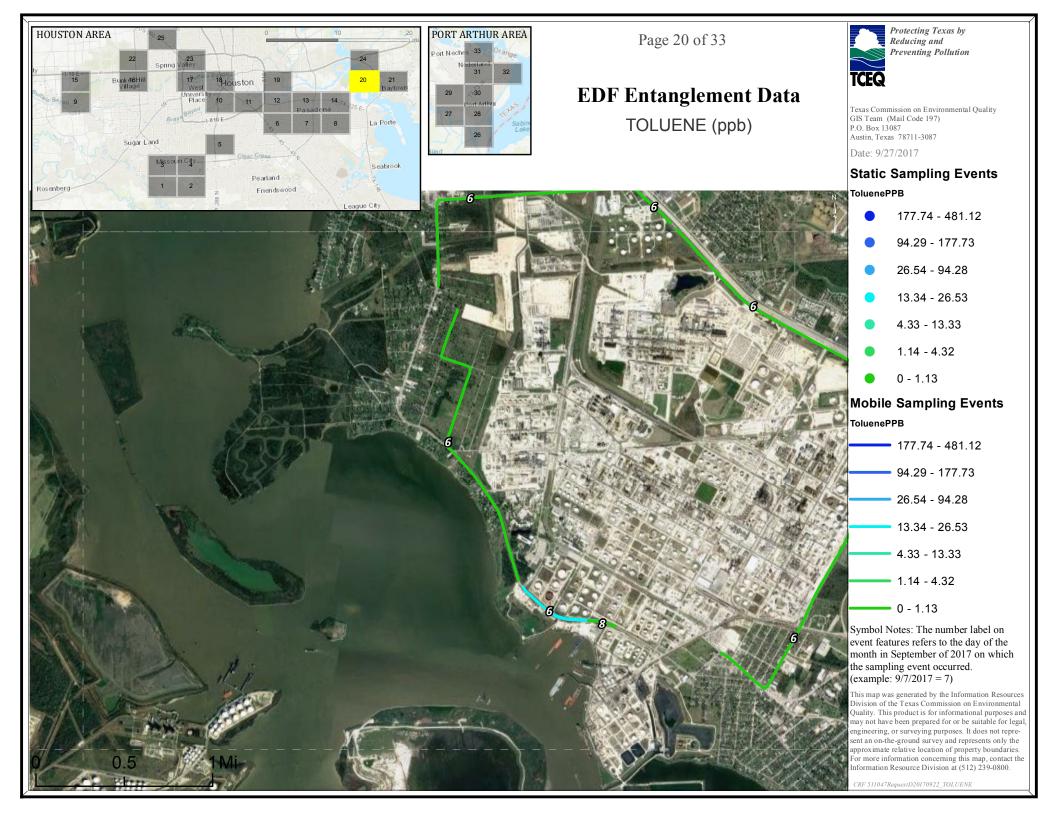
- **177.74 481.12**
- 94.29 177.73
 - 26.54 94.28
 - 13.34 26.53
 - 4.33 13.33
 - 1.14 4.32

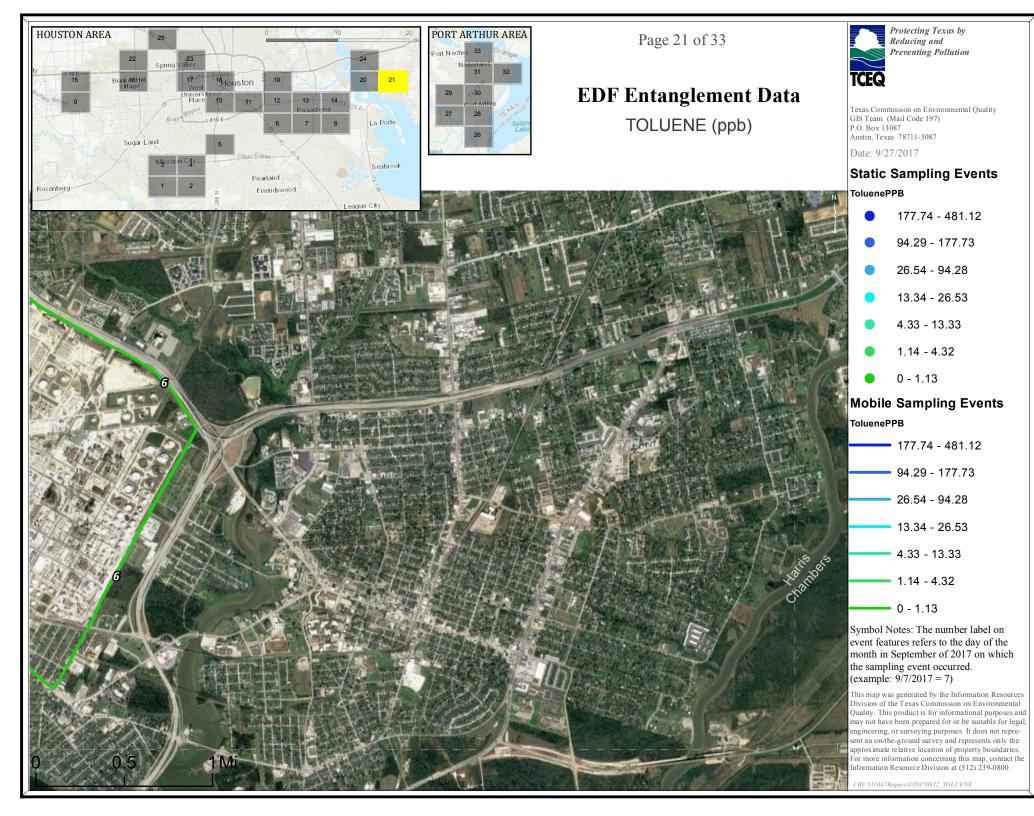
0 - 1.13

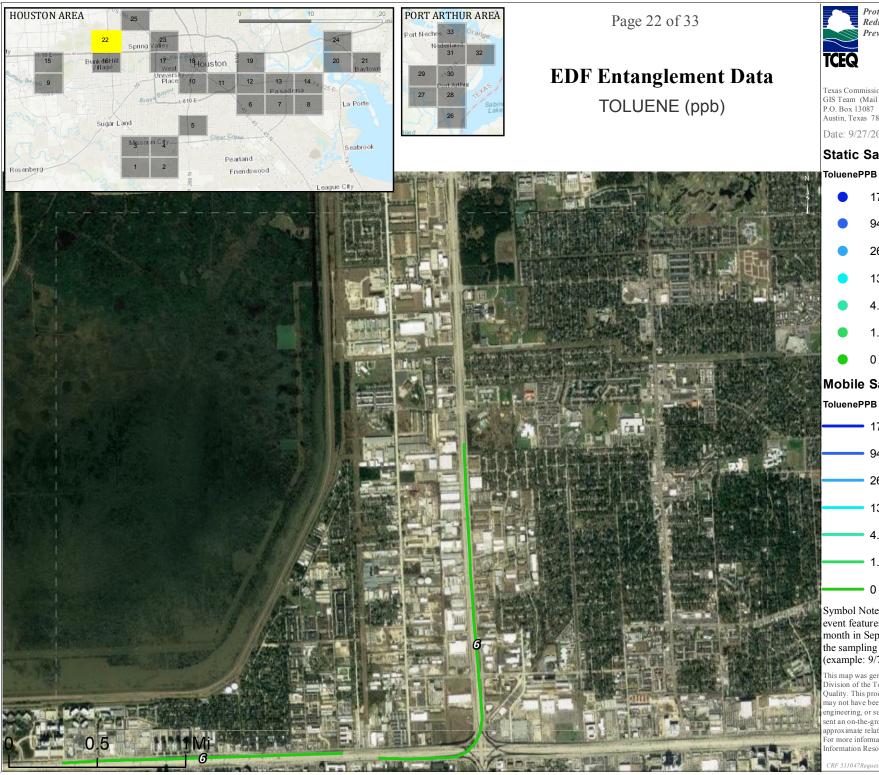
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CRF 511047RequestD20170922_TOLUENE







Protecting Texas by Reducing and Preventing Pollution

Texas Commission on Environmental Quality GIS Team (Mail Code 197) Austin, Texas 78711-3087

Date: 9/27/2017

Static Sampling Events

ToluenePPB

- 177.74 481.12
- 94.29 177.73
- 26.54 94.28
- 13.34 26.53
- 4.33 13.33
- 1.14 4.32
- 0 1.13

Mobile Sampling Events

177.74 - 481.12

94.29 - 177.73

26.54 - 94.28

13.34 - 26.53

4.33 - 13.33

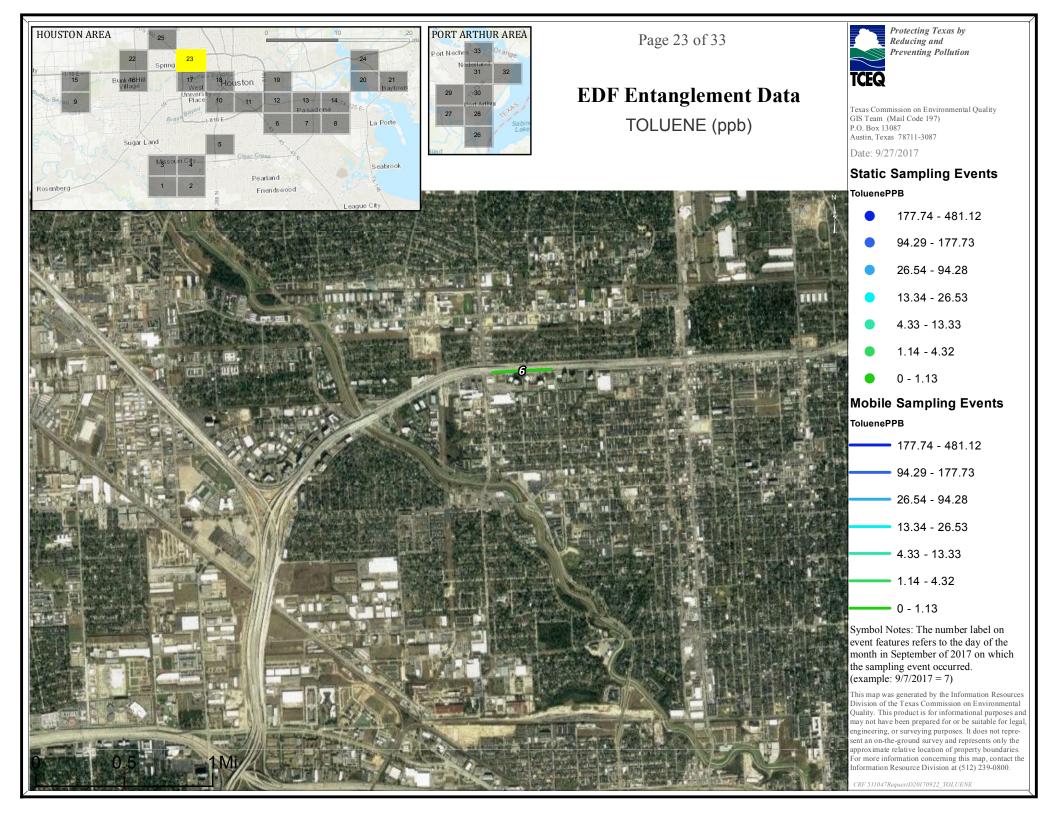
1.14 - 4.32

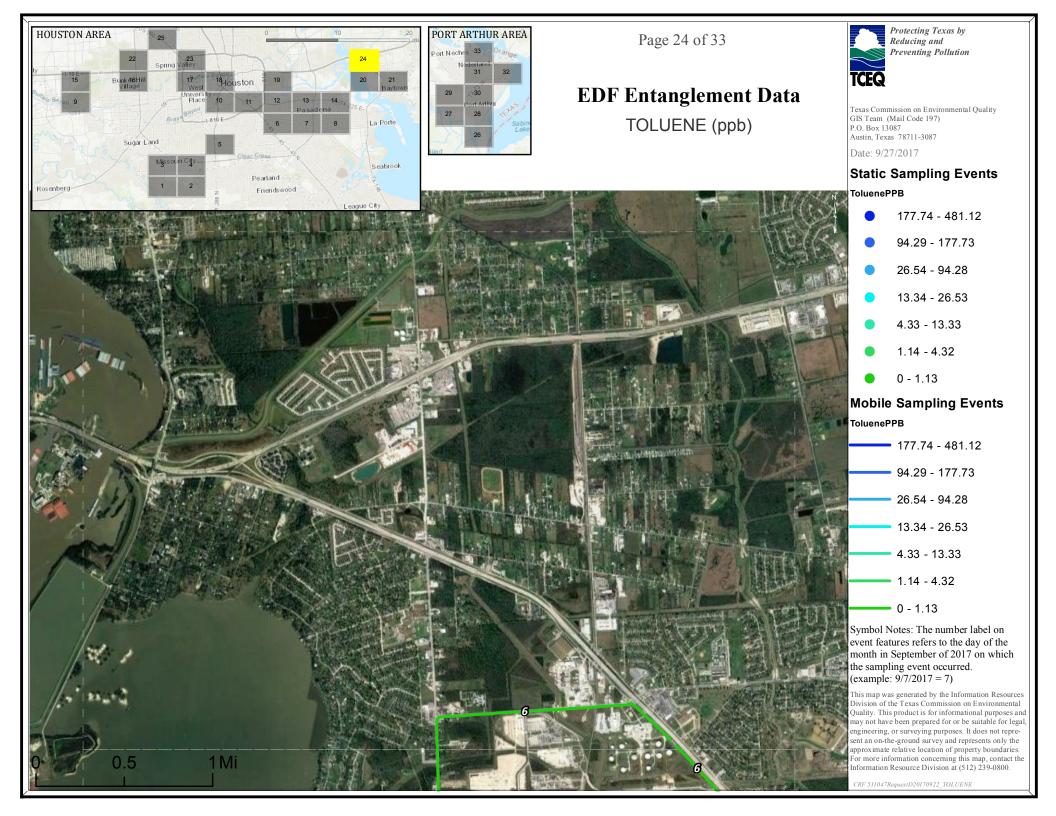
0 - 1.13

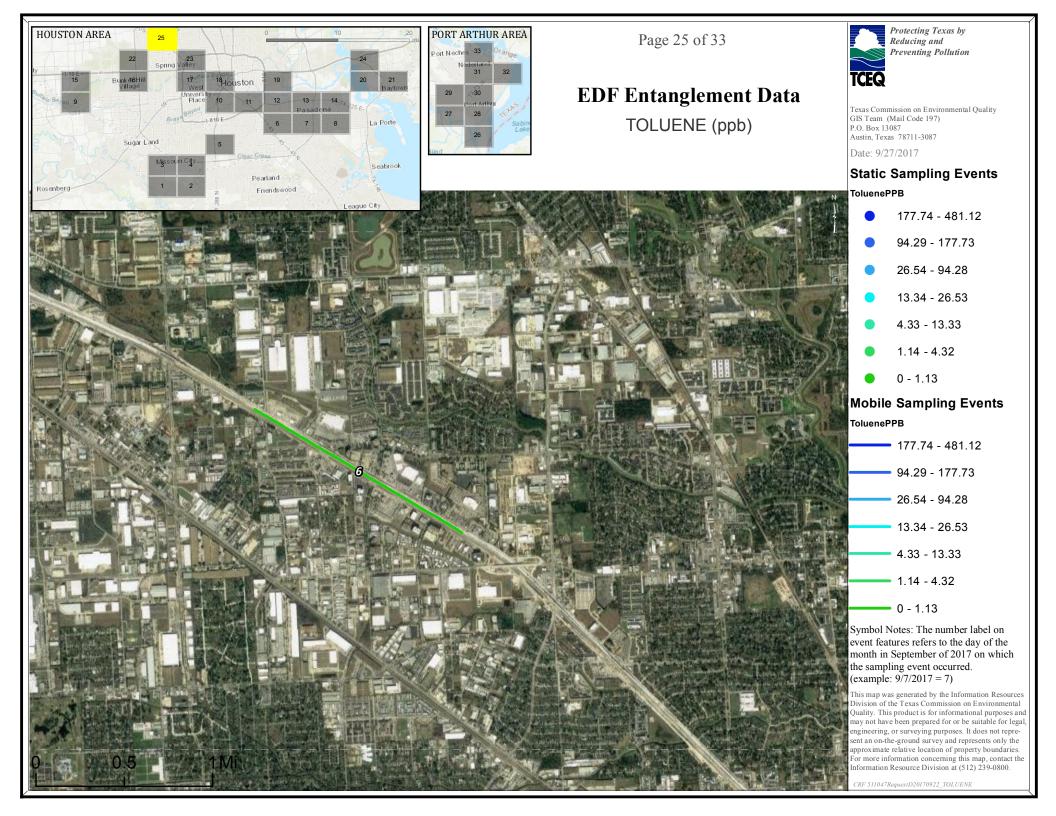
Symbol Notes: The number label on event features refers to the day of the month in September of 2017 on which the sampling event occurred. (example: 9/7/2017 = 7)

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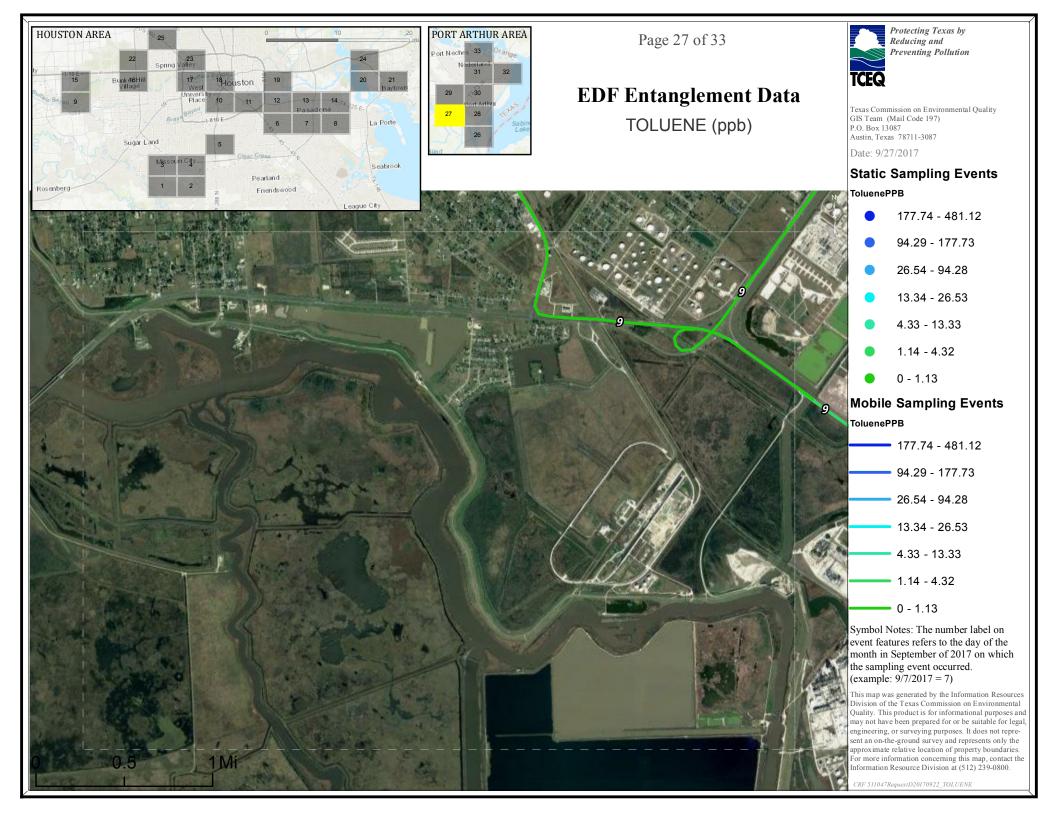
CRF 511047RequestD20170922 TOLUENE

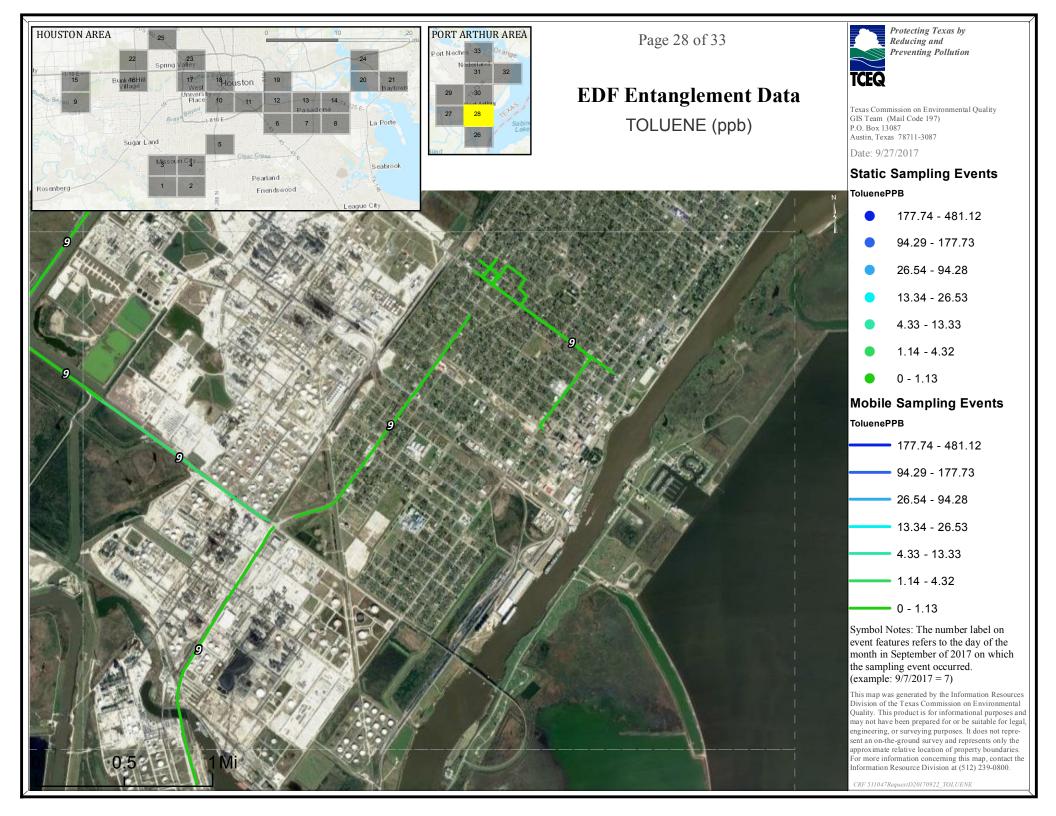


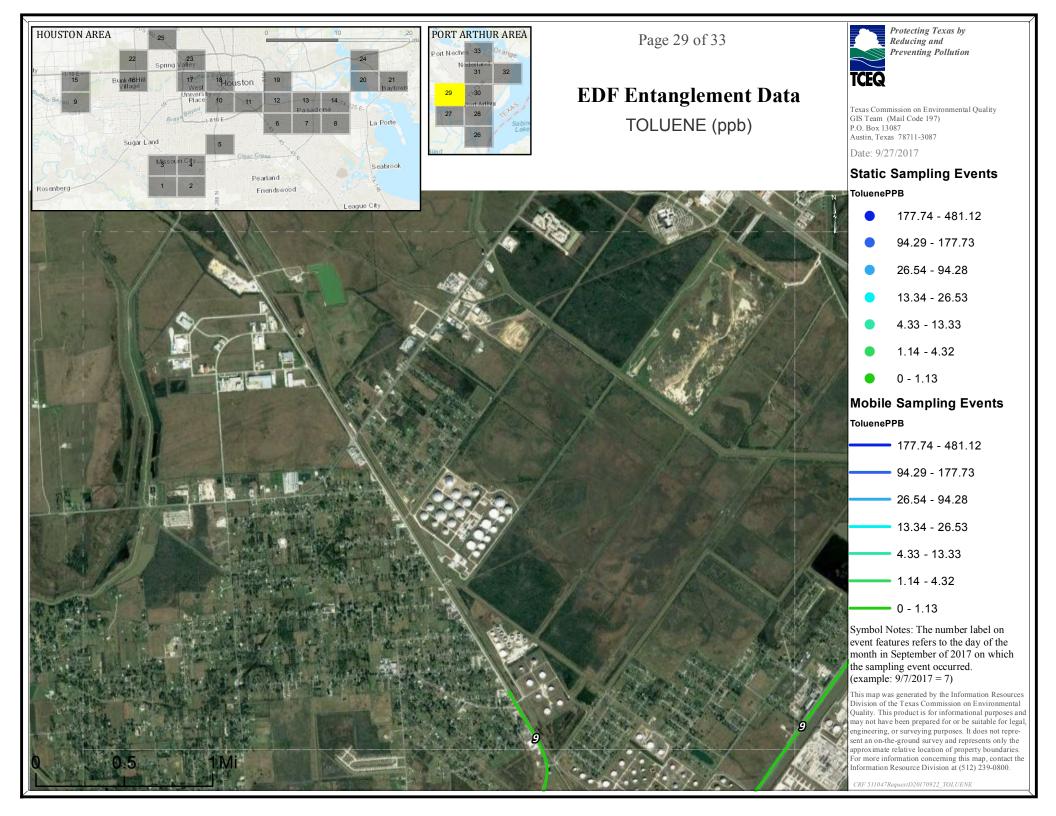


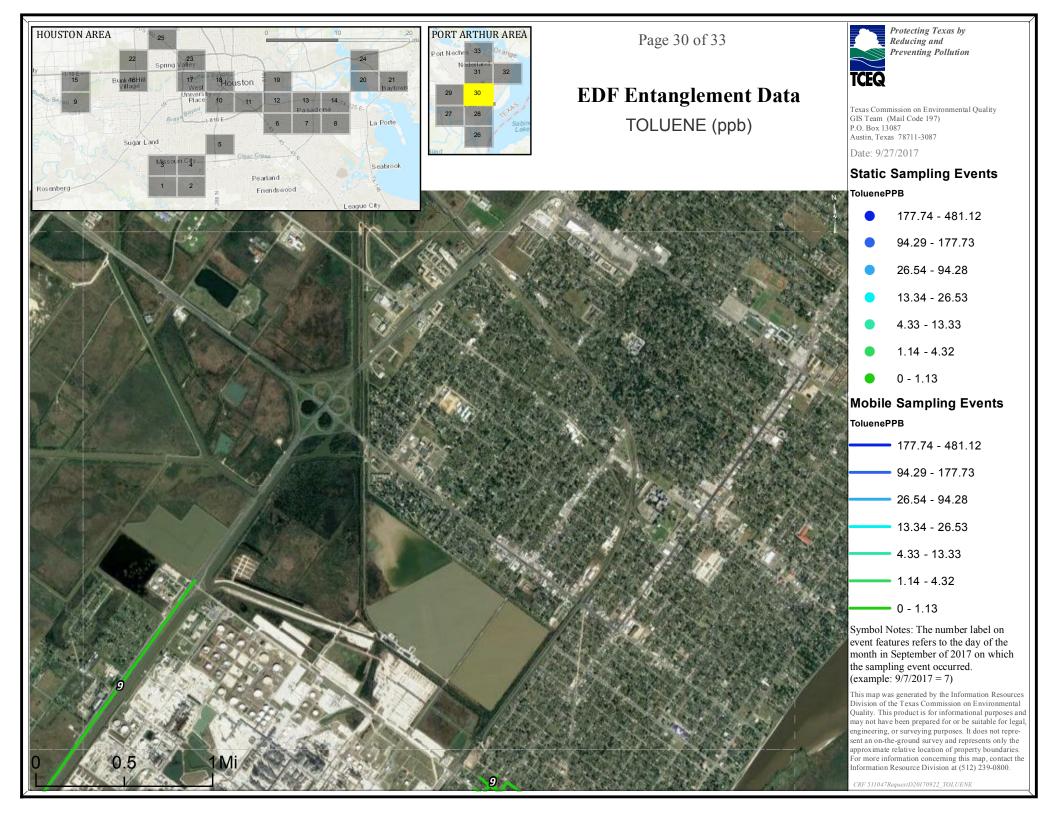


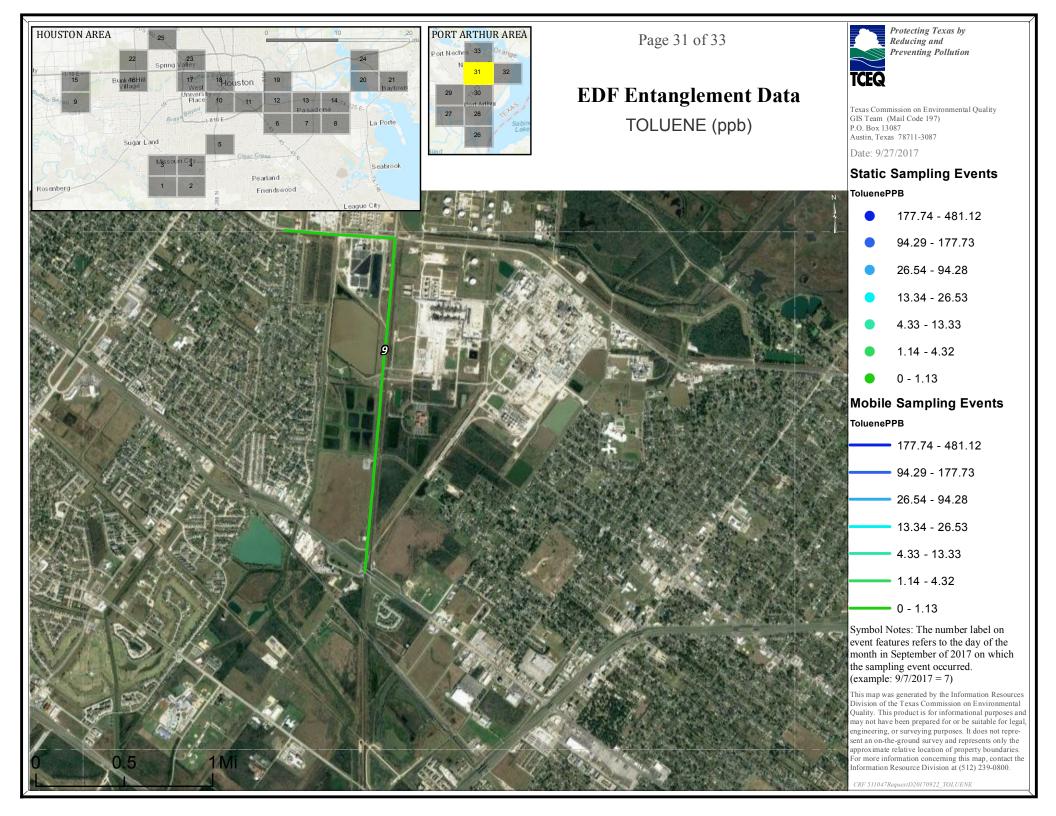


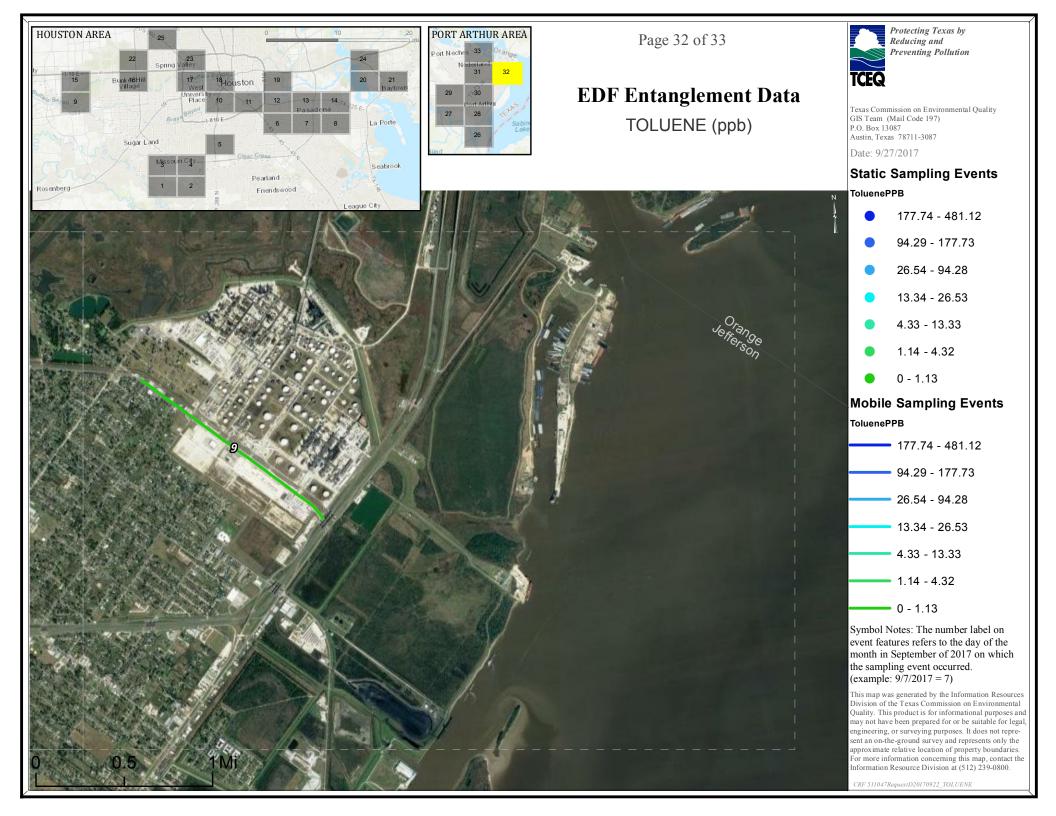


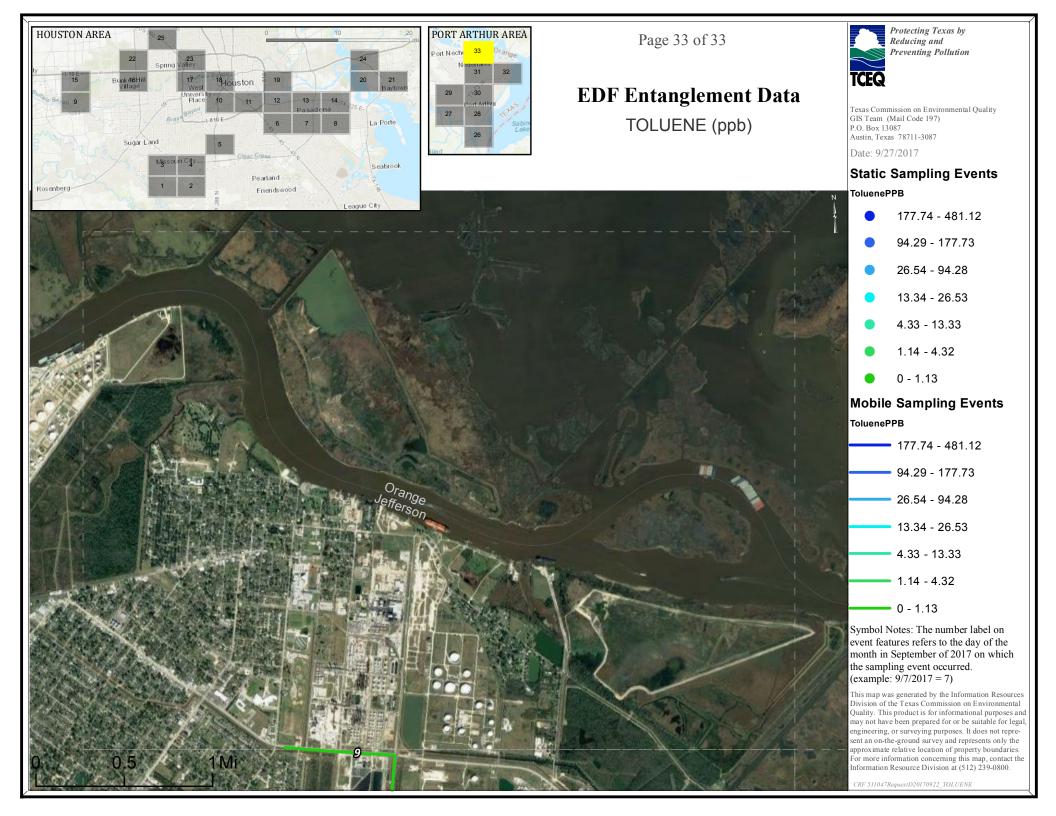


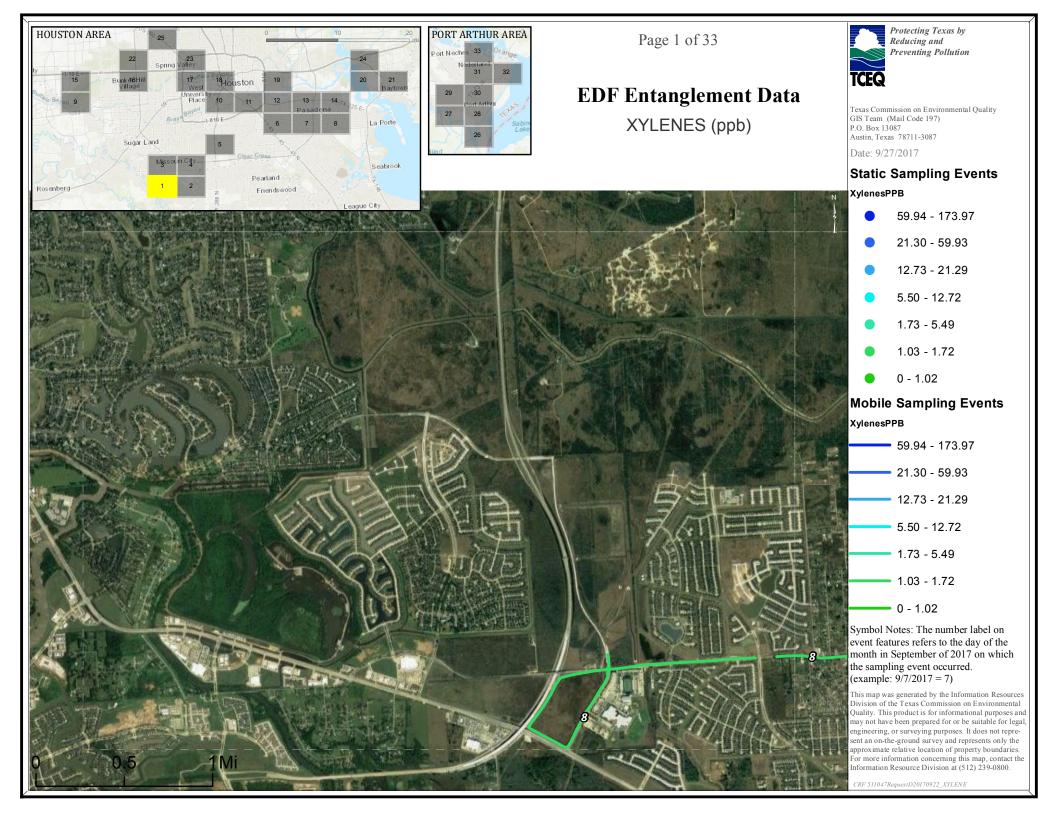


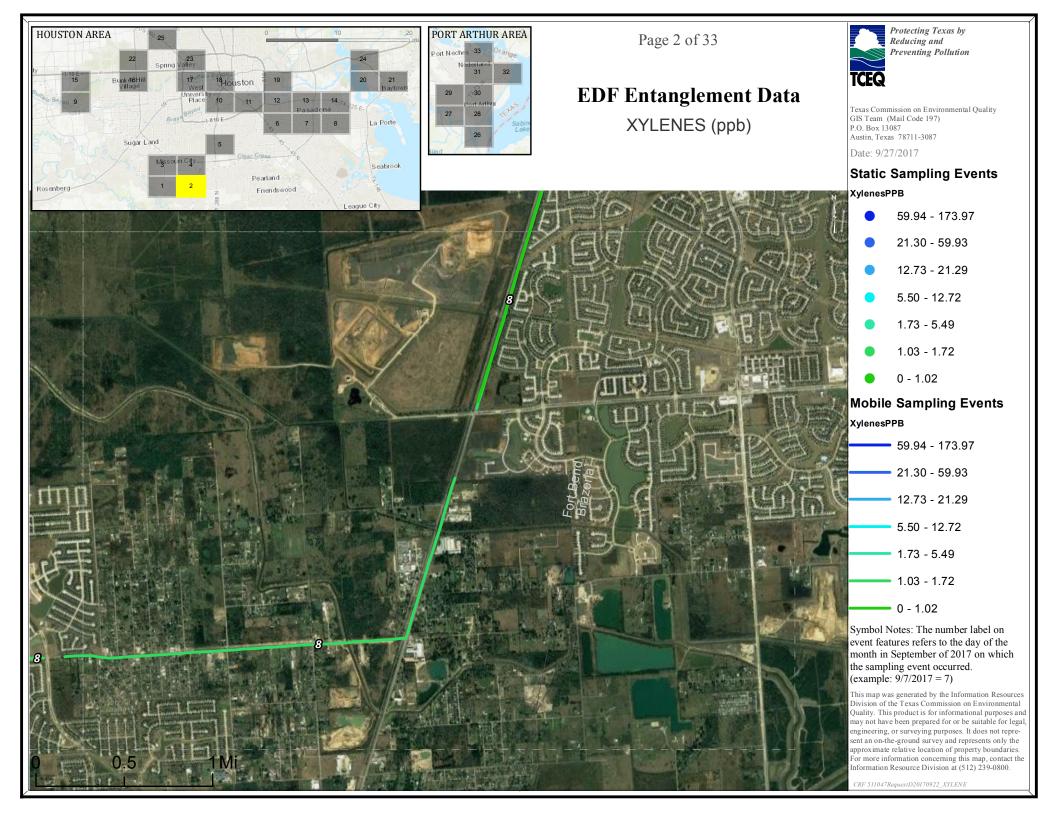


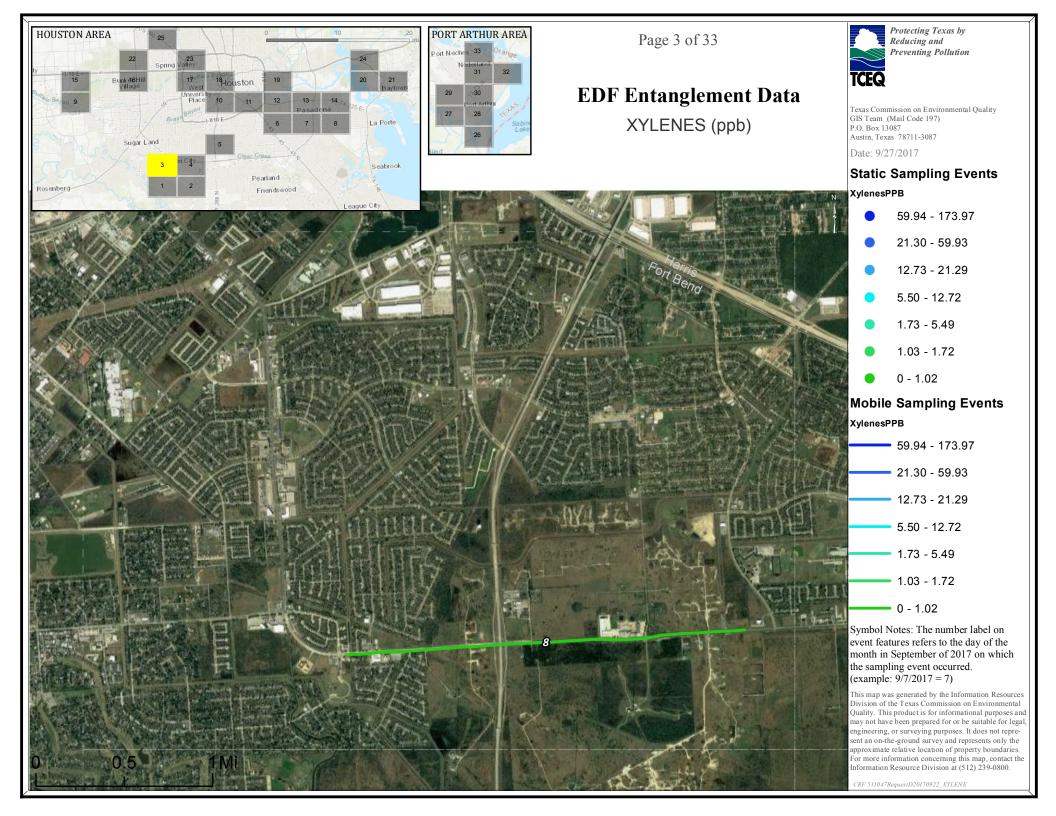


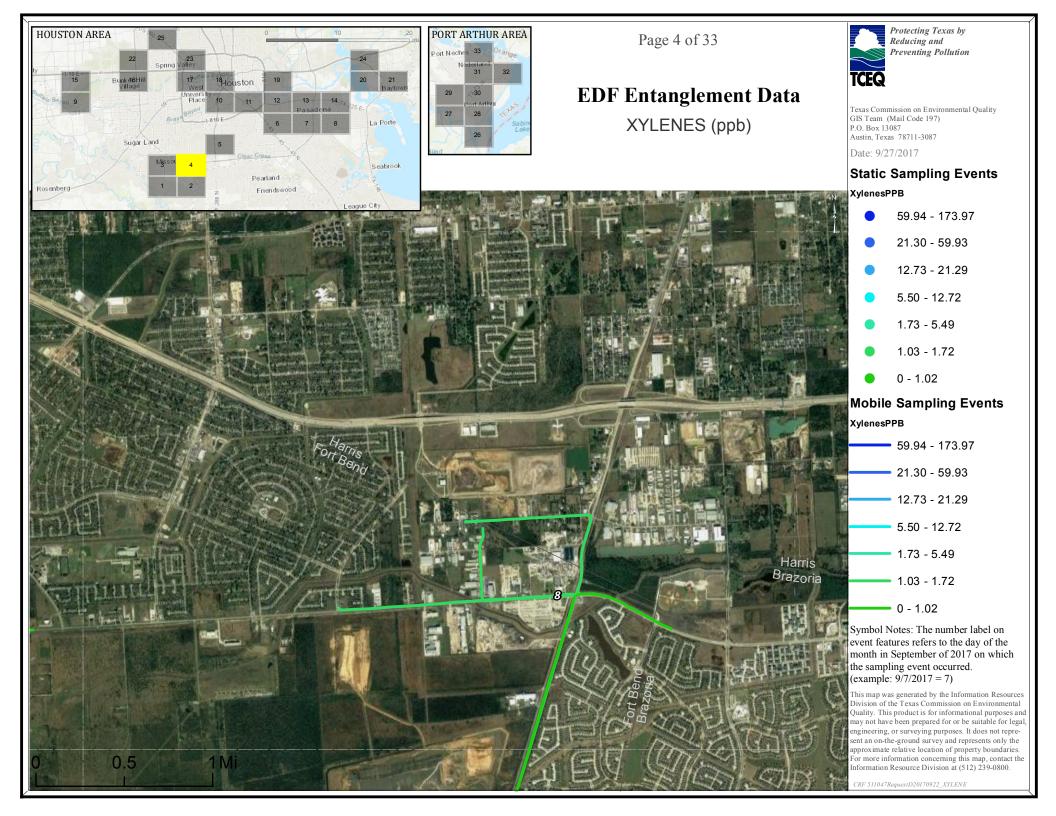


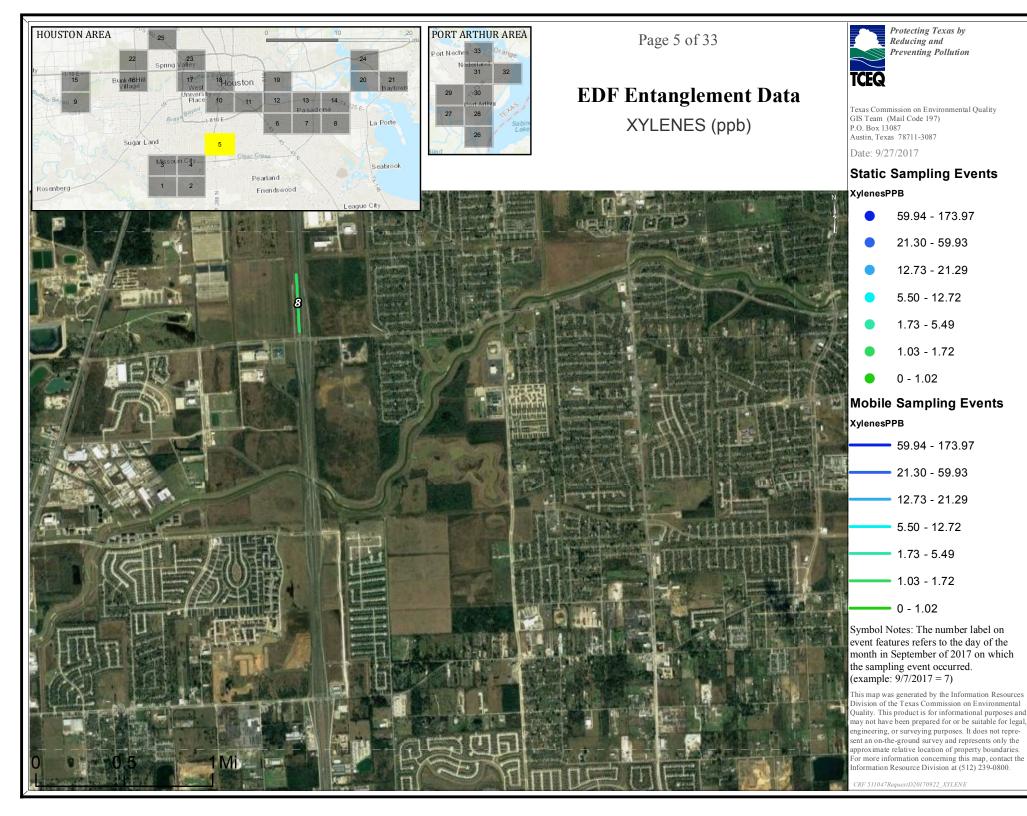


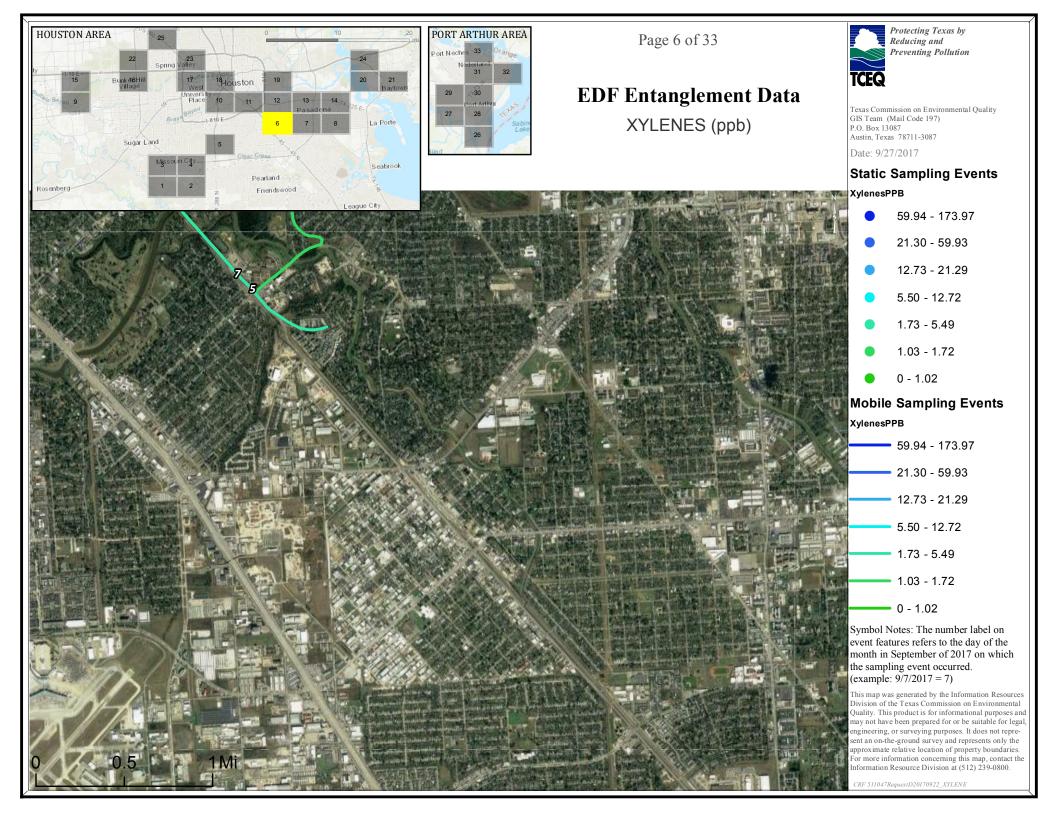


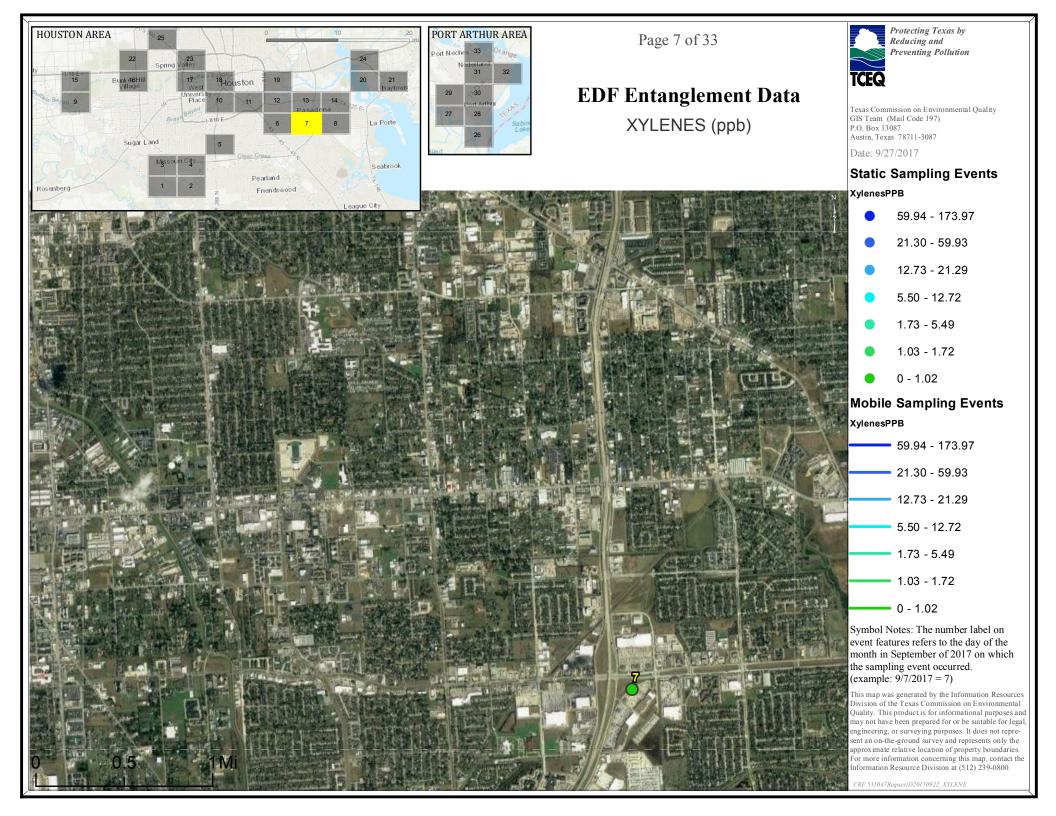


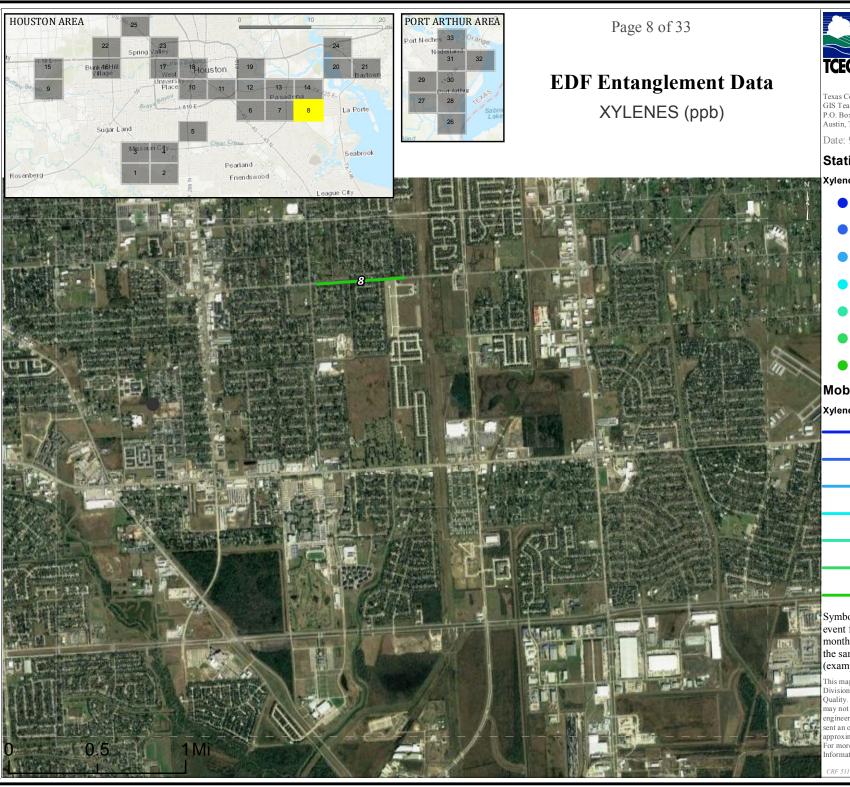












Protecting Texas by Reducing and Preventing Pollution

Texas Commission on Environmental Quality GIS Team (Mail Code 197) P.O. Box 13087 Austin, Texas 78711-3087

Date: 9/27/2017

Static Sampling Events

XylenesPPB

- 59.94 173.97
- 21.30 59.93
- 12.73 21.29
- 5.50 12.72
- 1.73 5.49
- 1.03 1.72
- 0 1.02

Mobile Sampling Events

XylenesPPB

59.94 - 173.97

21.30 - 59.93

12.73 - 21.29

5.50 - 12.72

1.73 - 5.49

1.03 - 1.72

0 - 1.02

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CRF 511047RequestD20170922_XYLENE

