

An Assessment of the Presence and Causes of Ambient Toxicity in Seven Texas Waterbodies

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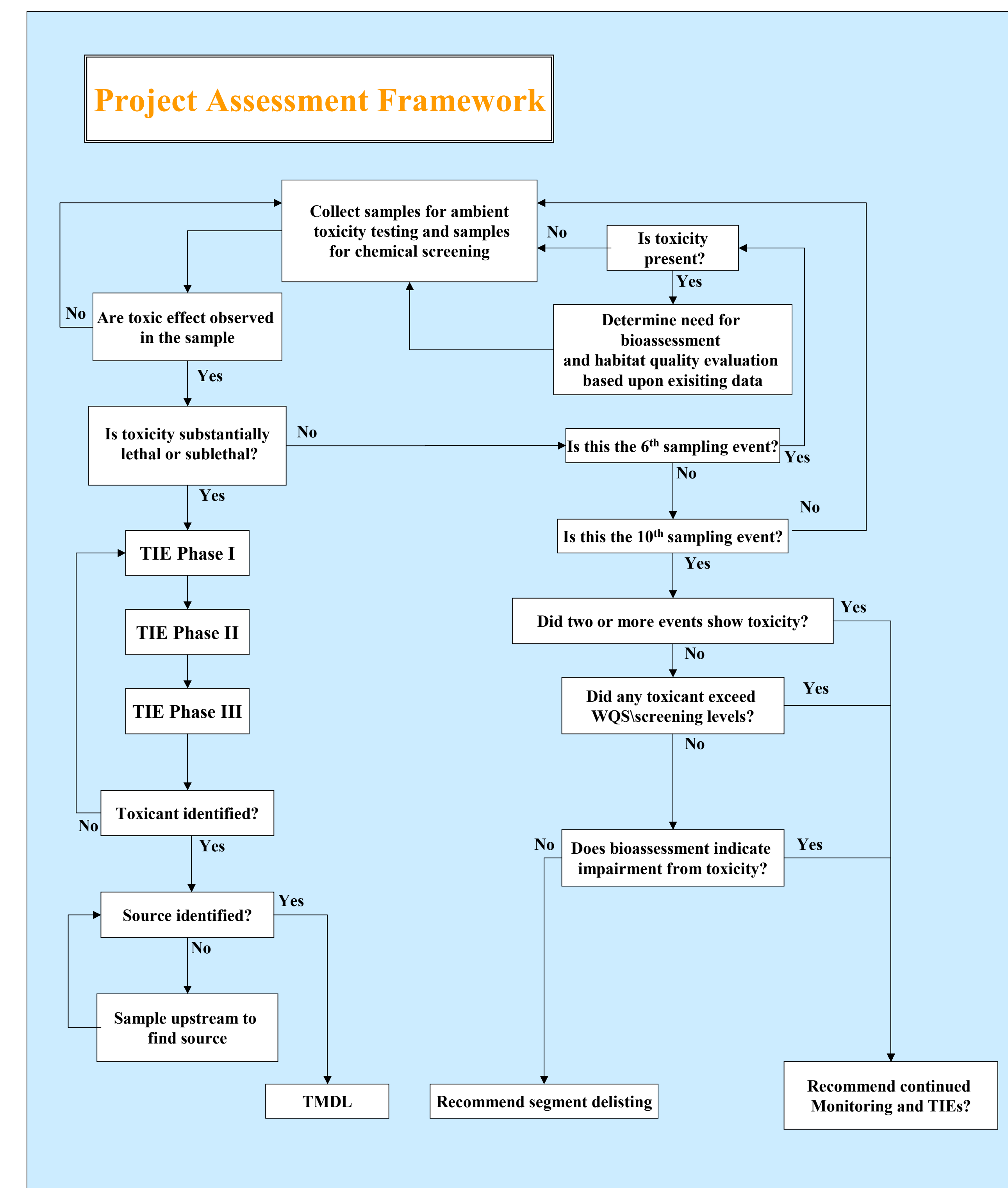
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Abstract

The Texas Commission on Environmental Quality (TCEQ) has recently completed a study to assess ambient water and/or sediment toxicity in seven impaired waterbodies throughout Texas. These include Alligator Bayou (Segment 702A - water and sediment), Vince Bayou (1007A - sediment), Bryan Municipal Lake (1209A - sediment), Finfeather Lake (1209B - sediment), Arroyo Colorado Tidal (2201 - sediment), Rio Grande below Amistad Reservoir (2304 - water), and Rio Grande above Amistad Reservoir (2306 - water). The study employed established chronic bioassay tests for water and the use of whole sediment toxicity tests. In areas where toxicity was found to exist, the causes of the toxicity were investigated through the use of Toxicity Identification Evaluation (TIE) procedures. Toxicity (lethal and/or sublethal) effects were observed in water for two of the three waterbodies assessed and in sediment for four out of the five waterbodies assessed. This study resulted in the removal of one waterbody from the list of impaired waterbodies (303(d) List). TIEs conducted on water and sediment provided varying results, however, in many instances additional tests were needed to adequately determine toxicity sources. The results of this study have also provided information concerning the methods and procedures used for monitoring and assessing ambient toxicity in water and sediment. This has led to the development of several recommendations for methodologies to be used in future assessments when considering ambient toxicity data and addressing narrative toxicity criteria

Methods



Acknowledgements

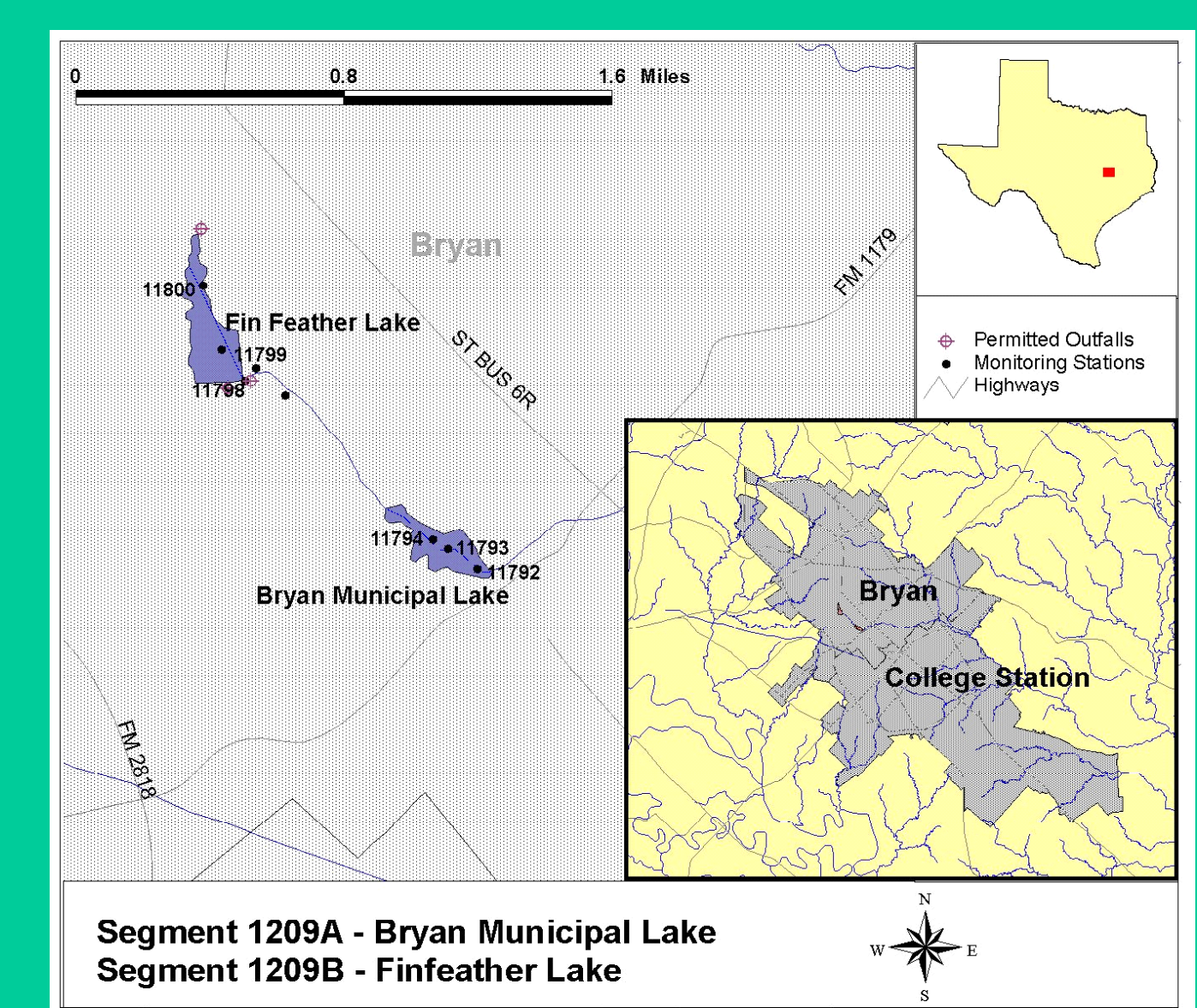
Toxicity tests and toxicity identification evaluations for Segments 1209A&B, 2304, 2306, and 702A were performed by Bryan W. Brooks, Philip K. Turner, Jacob K. Stanley, William T. Waller, Thomas W. La Point at the University of North Texas

Toxicity tests and toxicity identification evaluations for Segments 2201 and 1007A were performed by TRAC Laboratories, Pensacola FL

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Results

Bryan Municipal and Finfeather Lake



Station	Lethal				Sublethal			
	<i>C. tentans</i>		<i>H. azteca</i>		<i>C. tentans</i>		<i>H. azteca</i>	
	# tests	# toxic	# tests	# toxic	# tests	# toxic	# tests	# toxic
11792-BML	1	2	0	2	1	1	1	2
11793-BML	1	2	0	2	1	1	2	2
11794-BML	0	2	0	2	1	1	0	2
11798-FFL	2	2	1	2	2	2	2	2
11799-FFL	1	2	0	2	2	2	0	2
11800-FFL	1	2	1	2	2	2	1	2

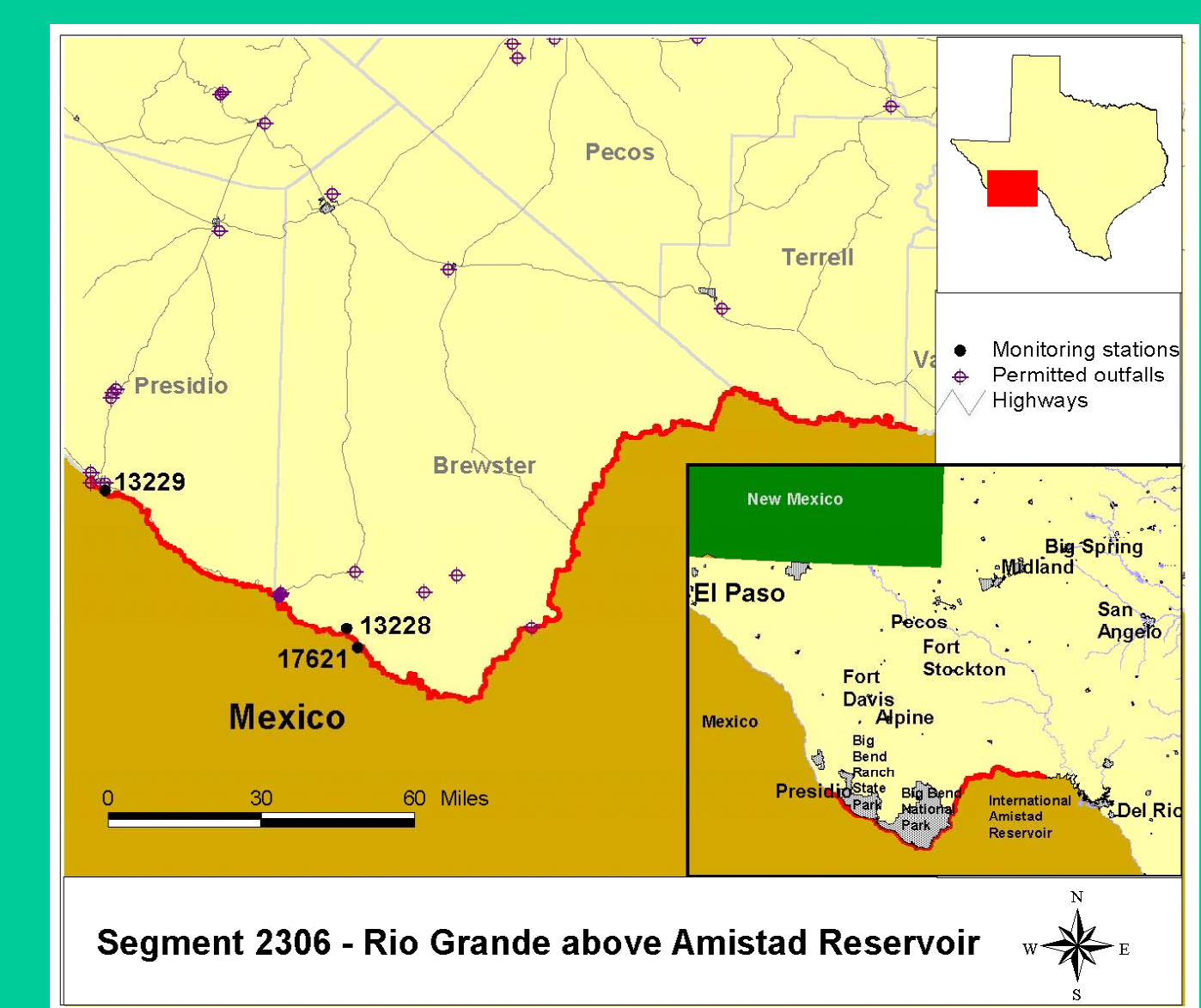
Test Results and Toxicity Identification

Using whole sediment test methods, toxicity test results indicated that the sediment was significantly toxic to *Chironomus tentans* and *Hyalella azteca* species in both lakes, with lethality at all stations in Finfeather Lake; and in Stations 11792 and 11793 in Bryan Municipal Lake. Statistically significant sublethal effects were also observed in sediment taken from Station 11800 and 11798 in Finfeather Lake and from all stations in Bryan Municipal Lake. Toxicity identification evaluation (TIE) procedures were conducted on sediment samples from Station 11798. These analyses indicate that a metal is the source of the observed toxicity. Chemical analyses of porewaters indicate elevated levels of copper.

Segment Recommendations:

Sediment toxicity tests indicate significant levels of toxicity to benthic invertebrates. Initial analyses appear to indicate that a metal or complex of metals is responsible for the toxicity. Further TIE procedures should be performed to identify the metal(s) responsible, and a TMDL should be initiated.

Rio Grande above Amistad Reservoir



Station	Lethal				Sublethal			
	Fathead		<i>C. dubia</i>		Fathead		<i>C. dubia</i>	
	# tests	# toxic	# tests	# toxic	# tests	# toxic	# tests	# toxic
17621								
13228								
13229								

Inconclusive

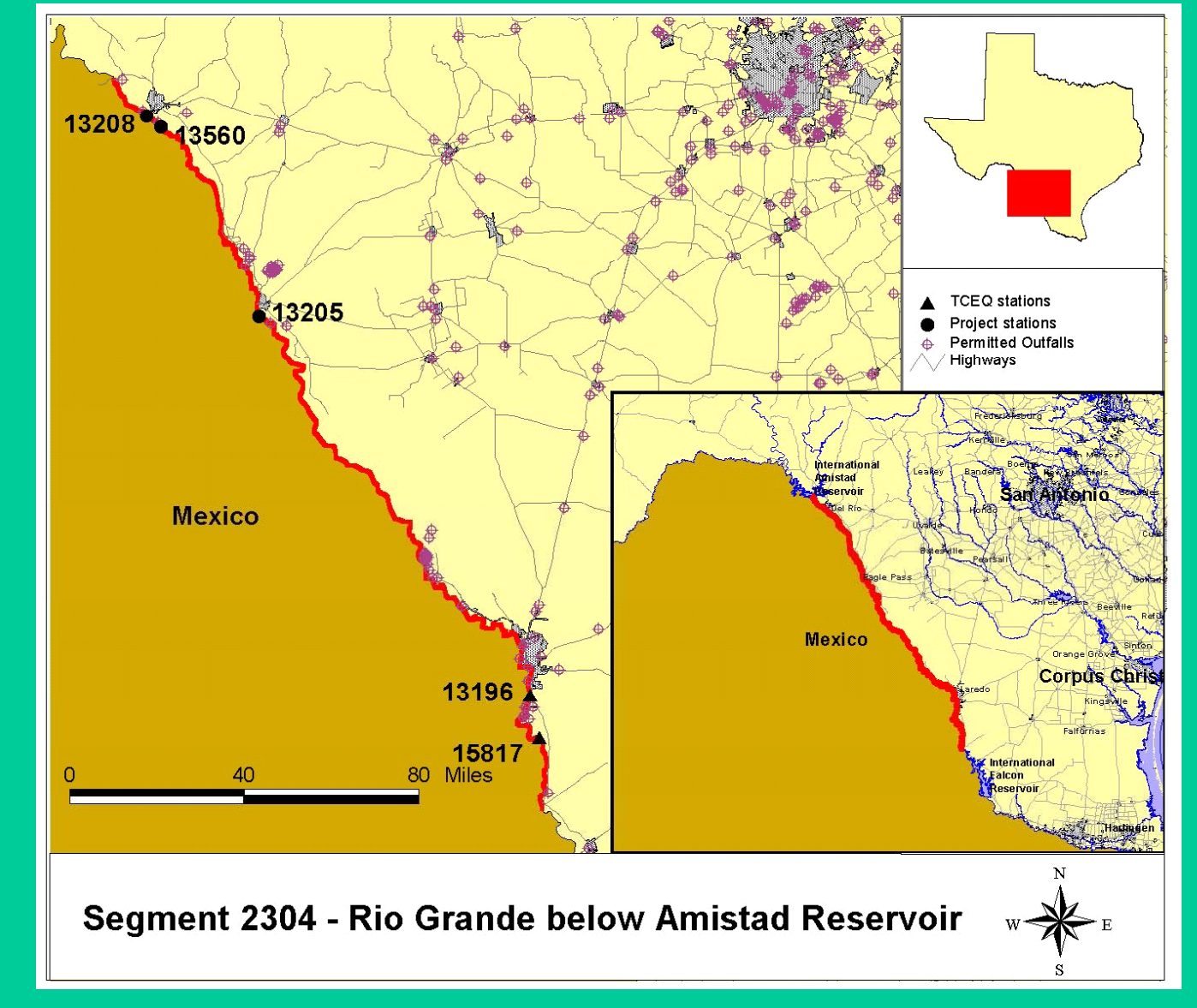
Test Results and Toxicity Identification

From April 29, 2001, through April 24, 2002, nine sampling events were conducted at Stations 13228 and 13229. The EPA also performed toxicity tests on samples collected by the TCEQ on two other separate events at each of the stations. Lethal toxicity was not observed at any of the events for either of the species. The recorded flow for this segment during each of the sampling events was below the levels required for water quality standards to be applicable. As a result, sublethal effects observed in this study are inconclusive since aquatic life uses would not be applicable during extremely low flows. Toxicity identification evaluations (TIE) were not conducted due to the ambiguous results from the toxicity tests.

Segment Recommendations:

Toxicity tests conducted on fish and invertebrates using water samples from Segment 2306 were inconclusive. The interpretation of sublethal responses is complicated by low flow conditions at the time of sampling. Additional toxicity tests are required to fully assess the presence and causes of toxicity in this segment.

Rio Grande below Amistad Reservoir



Station	Lethal				Sublethal			
	Fathead		<i>C. dubia</i>		Fathead		<i>C. dubia</i>	
	# tests	# toxic	# tests	# toxic	# tests	# toxic	# tests	# toxic
13205	0	6	0	9	0	6	1	9
13208	0	6	0	9	0	6	0	9
13560	0	6	0	9	0	6	0	9
13196	0	3	0	3	0	1	1	2
15817	0	3	0	3	0	1	1	2

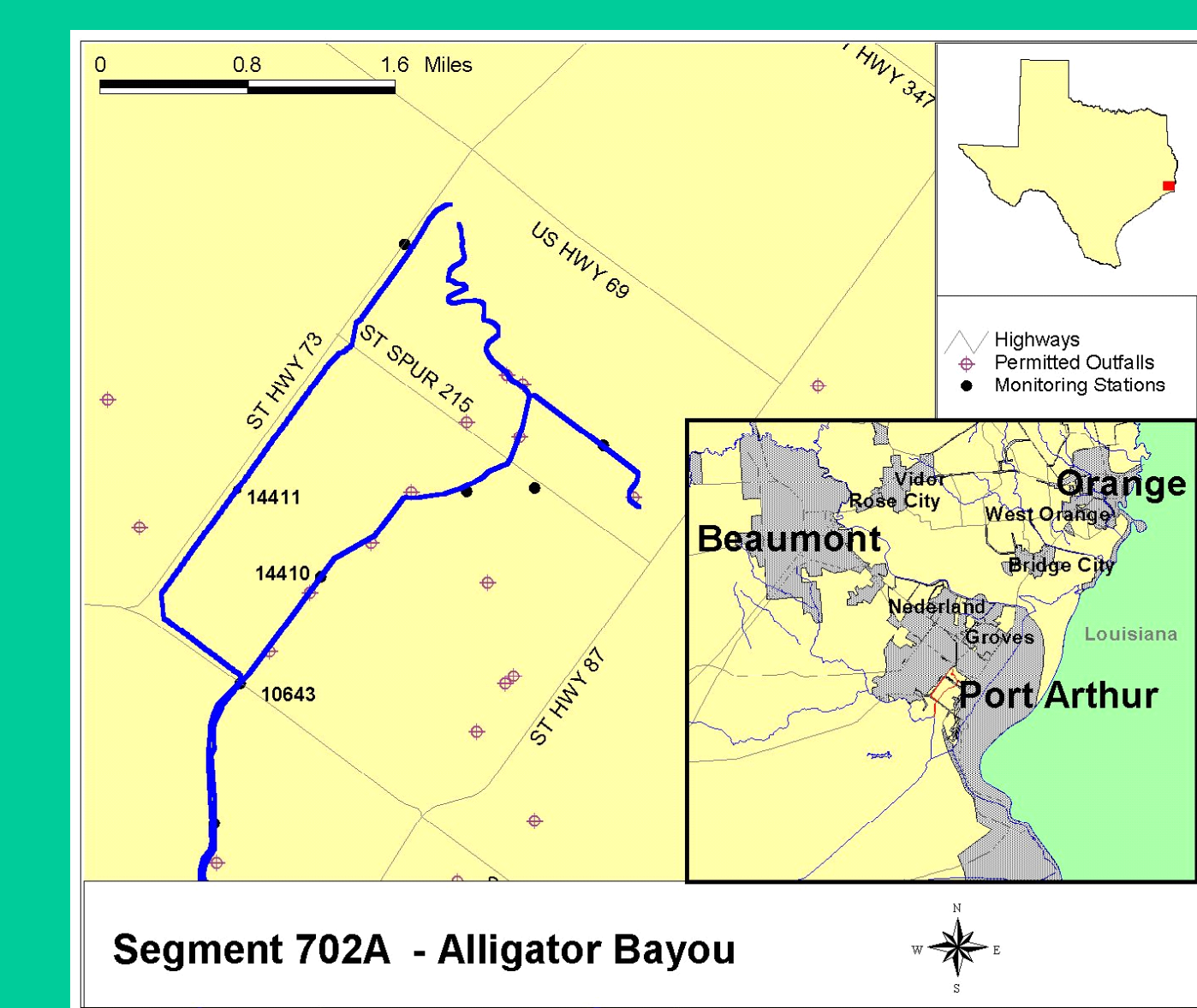
Test Results and Toxicity Identification

Throughout the nine sampling events at three stations (13205, 13208, 13560) on this segment, lethal toxicity was not observed at any time. Sublethal toxicity occurred in one species during one event at Station 13205. Three additional toxicity tests, not connected with this project, were conducted by the TCEQ at two stations (13196 and 15817) during the same time frame. No lethal toxic effects were observed at either of the stations. Sublethal effects were identified for *C. dubia* during a single event at two stations. Minimal amounts of sublethal toxicity were observed at all of the stations within this study. As a result, toxicity identification evaluations were not conducted on any of the samples

Segment Recommendations:

Tests conducted on water samples indicate no toxicity to fish and minimal levels of sublethal toxicity to invertebrates. Compilation of the data from this project and that collected by TCEQ indicates that aquatic life uses are not impaired due to toxicity. It is therefore recommended that this segment be removed from the 303(d) List.

Alligator Bayou



Station	Lethal				Sublethal			
	Fathead		<i>C. dubia</i>		Fathead		<i>C. dubia</i>	
	# tests	# toxic	# tests	# toxic	# tests	# toxic	# tests	# toxic
10643	0	7	1	10	0	7	1	10
14410	1	7	1	11	1	7	5	11
14411	0	7	3	11	0	7	3	11

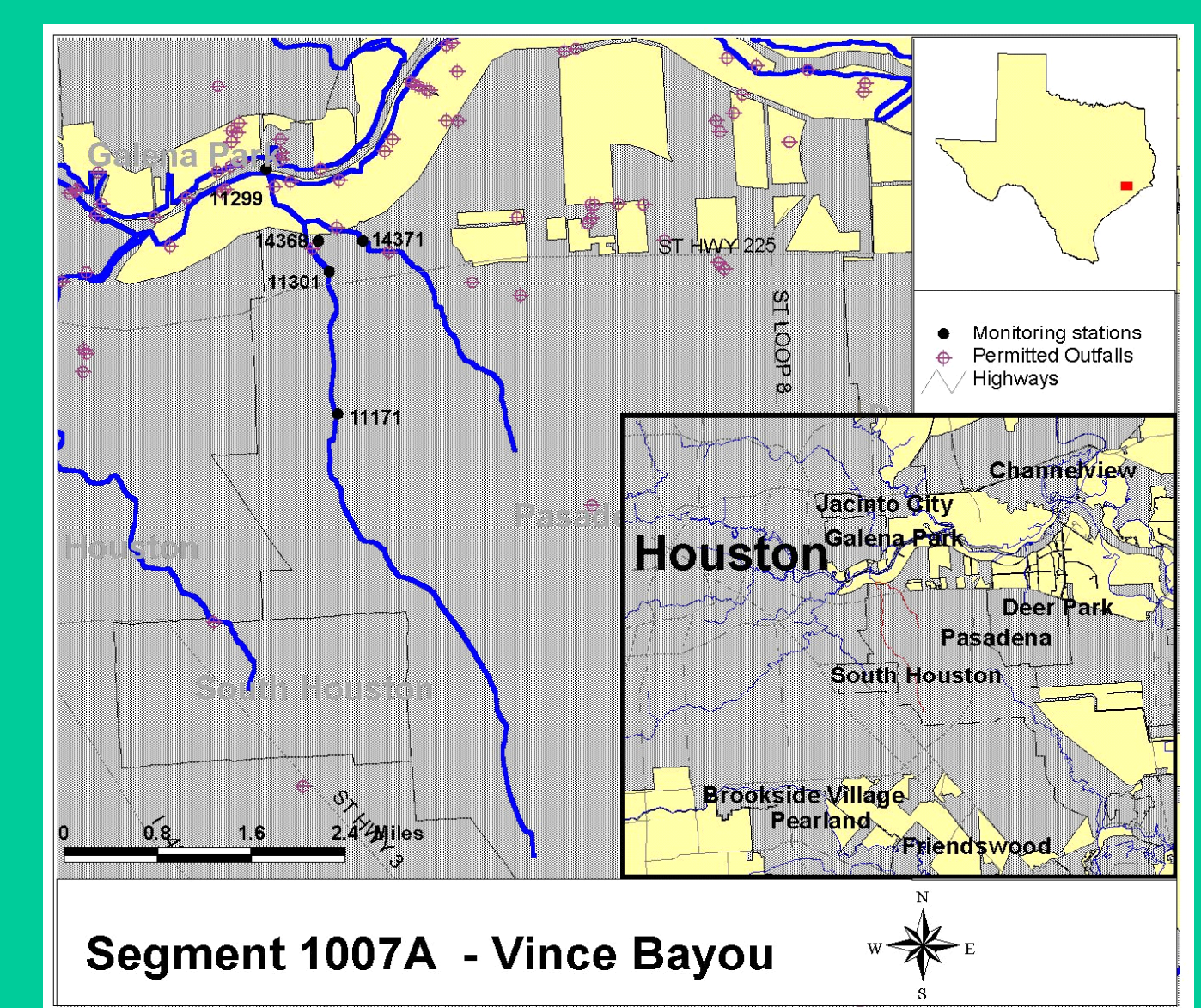
Test Results and Toxicity Identification

The water toxicity found in the initial samples from Station 14411 ceased to occur after August 2001. Toxicity identification evaluation (TIE) procedures were conducted on the toxic samples collected prior to August from Stations 14410 and 14411. Due to the high level of toxicity and the complex mixture of the compounds, identification of the cause is not possible with current technologies. Considerable amounts of lethal and sublethal toxicity were found in sediments at each of the stations. Sediment toxicity is attributable to a combination of metals and organic compounds. The degree of contamination in Alligator Bayou below the Motiva discharge at Station 14410 is substantial, as indicated by the significant sample dilution (6.25%) required for TIE procedures.

Segment Recommendations:

Water and sediment toxicity tests indicate significant levels of toxicity to fish and invertebrates. Due to the complex nature of the compounds causing the toxicity, current technologies are unable to isolate a cause. Additional testing using more advanced techniques will be necessary to determine specific toxins.

Vince Bayou



Station	Lethal			
	<i>Neanthes</i>		<i>Leptocheirus</i>	
	# tests	# toxic	# tests	# toxic
11299	0	3	0	3
14368	1	9	6	9
14371	0	2	0	2
11301	0	1	1	2
11171	0	1	0	2

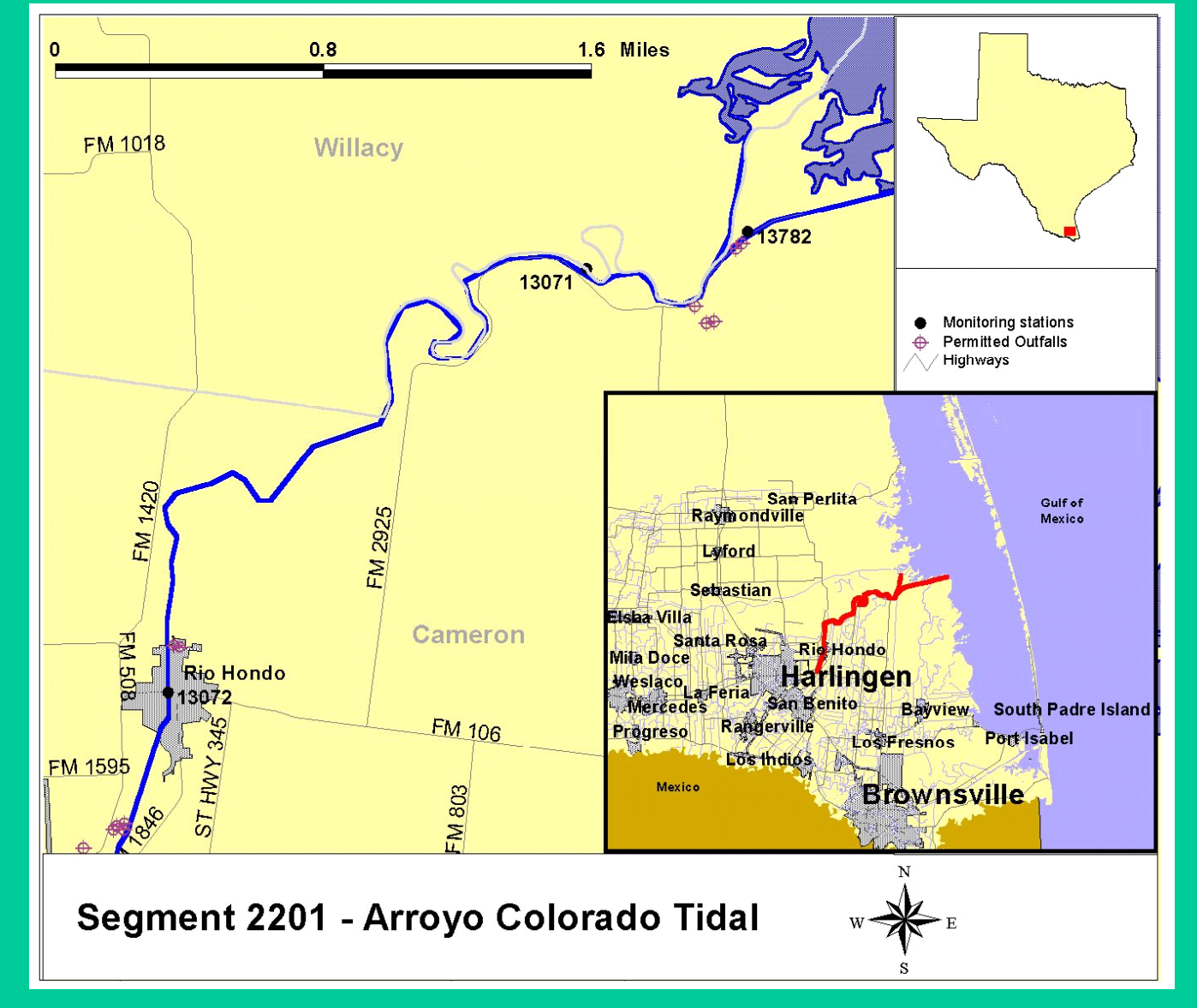
Test Results and Toxicity Identification

Significant sediment toxicity was found to occur at Station 14368 during the first two sampling events. As a result, Toxicity identification evaluation (TIE) procedures were conducted on samples from this station. Toxicity was not found at any of the other stations (11299 or 14371) during the course of this study. The initial TIE procedures indicate that organics (petroleum hydrocarbons) may be the cause of contamination. This conclusion is supported by the detection of several polycyclic aromatic hydrocarbons in the sediment at concentrations well above acceptable toxicity screening levels. However, additional TIE procedures performed to further characterize the cause of the toxicity identified the compound caprolactam. Caprolactam is a compound most commonly used in the production of synthetic fibers.

Segment Recommendations:

Sediment toxicity tests indicate significant levels of toxicity to invertebrates. TIE procedures have found the compound caprolactam to be the cause of the observed toxicity. Subsequent work should involve the identification of potential sources of caprolactam and to allocate loads appropriately to alleviate observed ambient toxicity.

Arroyo Colorado Tidal



Station	Lethal			
	<i>Neanthes</i>		<i>Leptocheirus</i>	
	# tests	# toxic	# tests	# toxic
13782	0	10	0	10
13071	0	10	0	10
13072	0	10	0	10

Test Results and Toxicity Identification

Ten sediment samples were collected from three stations over a 12-month period. None were toxic to any of the benthic invertebrates tested. In addition, the sediment chemistry results did not exceed any applicable screening values. Since there were no toxic effects observed in any of the samples, toxicity identification evaluation (TIE) procedures were not necessary.

Segment Recommendations:

Sediment toxicity tests indicate no toxicity to benthic invertebrates; therefore, it is recommended that the tidal portion of the Arroyo Colorado be removed from the 303(d) List.