PCBs, Dioxins, and Furans in Sediment

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Cover photo: Trinity River downstream of US 90 near Liberty.

Introduction

PCBs are a class of 209 congeners that were manufactured from about 1929 to 1979 when they were banned. They were commonly sold for use as mixes called Aroclors (EPA, 2021). Because they were very stable, they were considered to be ideal for use in many products ranging from heat transfer fluids to carbonless copy paper. However, due to the same properties that made them stable, they are persistent in the environment and do not easily degrade. They can break down from more heavily chlorinated congeners to less chlorinated congeners over time. They are also fat soluble which leads to bioaccumulation in animal tissues.

Dioxins and furans are somewhat similar classes of chemicals. There are several hundred congeners as well but there are seventeen that are considered the most toxic. Unlike PCBs, dioxins and furans are not intentionally produced (EPA, 2021). They are produced as by-product contaminants of processes ranging from simple wood burning to production of various chemicals.

Background

In 1990, the Texas Department of State Health Services (TxDSHS) issued AL-2 for the Trinity River from the Clear Fork at the 7th Street Bridge in Fort Worth to the West Fork and downstream to the IH-20 bridge southeast of Dallas. This order prohibited the possession of fish due to unsafe levels of Chlordane in tissue. In 2002, this order was extended to the SH 34 bridge in Kaufman/Ellis counties by AL-14. An additional fish consumption advisory (ADV-25) was placed on the river between SH 34 and the discharge canal from Cedar Creek Reservoir in 2002 due to the presence of PCBs (polychlorinated biphenyls) and chlorinated pesticides in tissue. Possession bans AL-2 and AL-14 were rescinded with AL-17 in 2010 and were downgraded to a fish consumption advisory (ADV-43) in 2010. ADV-43 also extended the upstream boundary of the advisory for the West Fork up to Lake Worth Dam and defined the advisory as being due to elevated levels of PCBs and dioxins/furans in tissue. ADV-45 was released in 2010 and added a fish consumption advisory due to PCBs for Lake Worth in Fort Worth upstream to the dam of Eagle Mountain Reservoir.

ADV-43 and ADV-45 have been in place since 2010. In December of 2015, the downstream boundary of the advisories for PCBs and dioxins/furans was extended to the US 90 bridge in Liberty County with ADV-53. This advisory includes the whole of Lake Livingston, a large on-channel reservoir in the southern portion of the Trinity River basin that serves as a water supply and an extensive recreational fishery (TxDSHS, 2021). Due to the downstream progress of the fish consumption advisories and the hydrophobic nature of PCBs and dioxins/furans, it was determined that sediment samples should be collected at several locations throughout the basin. These sediment samples can be used to determine if there are any areas where these contaminants are entering the system and to what extent the contaminants still exist in the upstream reaches of the advisory area. This information will be provided to the appropriate agencies for enforcement action if necessary.

Study Area

In 2017, sediment samples were collected at ten sites upstream of Lake Livingston and at two sites downstream of the lake (Figure 1, Figure 2, Figure 3). These samples were collected with either a dredge or scoop in accordance with the Texas Commission on Environmental Quality procedures (TCEQ, 2012) depending on the flow conditions existing in the river at the time of sample collection with samples at wadeable sites typically being collected with a scoop as opposed to a dredge.

Four sites were sampled within Lake Livingston. Surface sediments were collected with a dredge in accordance with the Texas Commission on Environmental Quality procedures (TCEQ, 2012). Additionally, these four sites were cored using a custom coring boat and SDI VibeCore system. Each core was sampled in up to three depths within the post impoundment layer in an attempt to identify any changes to PCB and dioxin/furan concentrations over time. The post impoundment layer was determined by "(1) a visual examination of the core for in-place terrestrial materials, such as leaf litter, tree bark, twigs, intact roots, etc., concentrations of which tend to occur on or just below the pre-impoundment surface, (2) changes in texture from well sorted, relatively fine-grained sediment to poorly sorted mixtures of coarse and fine-grained materials, and (3) variations in the physical properties of the sediment, particularly sediment water content and penetration resistance with depth" (Dunbar, 2007). The depth of each core subsample was determined in the field based on the volume of the tube and the overall depth of penetration. The intent of the sub-samples was not to tie core subsamples to precise years but rather to obtain a more gross-scale determination of changes over time (e.g. Are contaminated sediments being covered by newer, un-contaminated sediments?) using the assumption that samples taken from deeper within the core correspond to earlier timeframes.

After a review of the data from the initial sixteen sites, ten additional sites were sampled across the northern portion of the basin in 2017. These sites were selected in order to bracket potential inputs as determined from the results of the previously sampled sites.

In 2021, twelve sites were sampled to further refine the potential areas of input based on the 2017 samples; four sites on the Clear Fork Trinity River in Fort Worth (Figure 4), four in Dallas (Figure 5), and four on the tributaries to White Rock Creek cove of Lake Livingston (Figure 6).

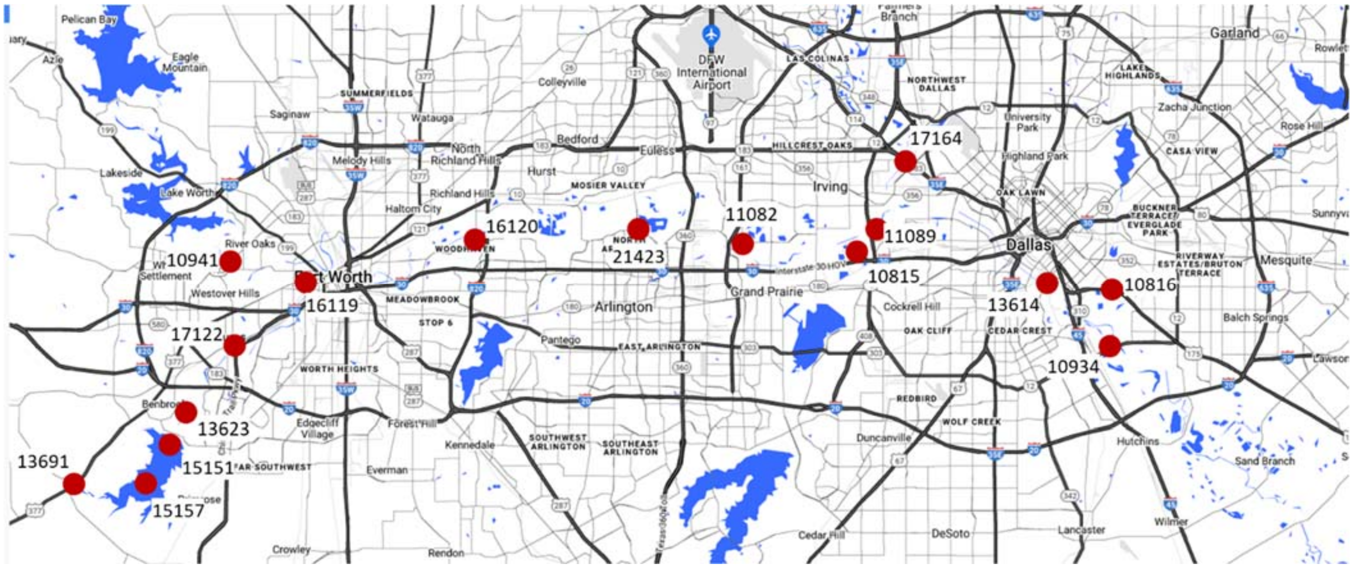

Figure 1: Upper Trinity 2017 sites.

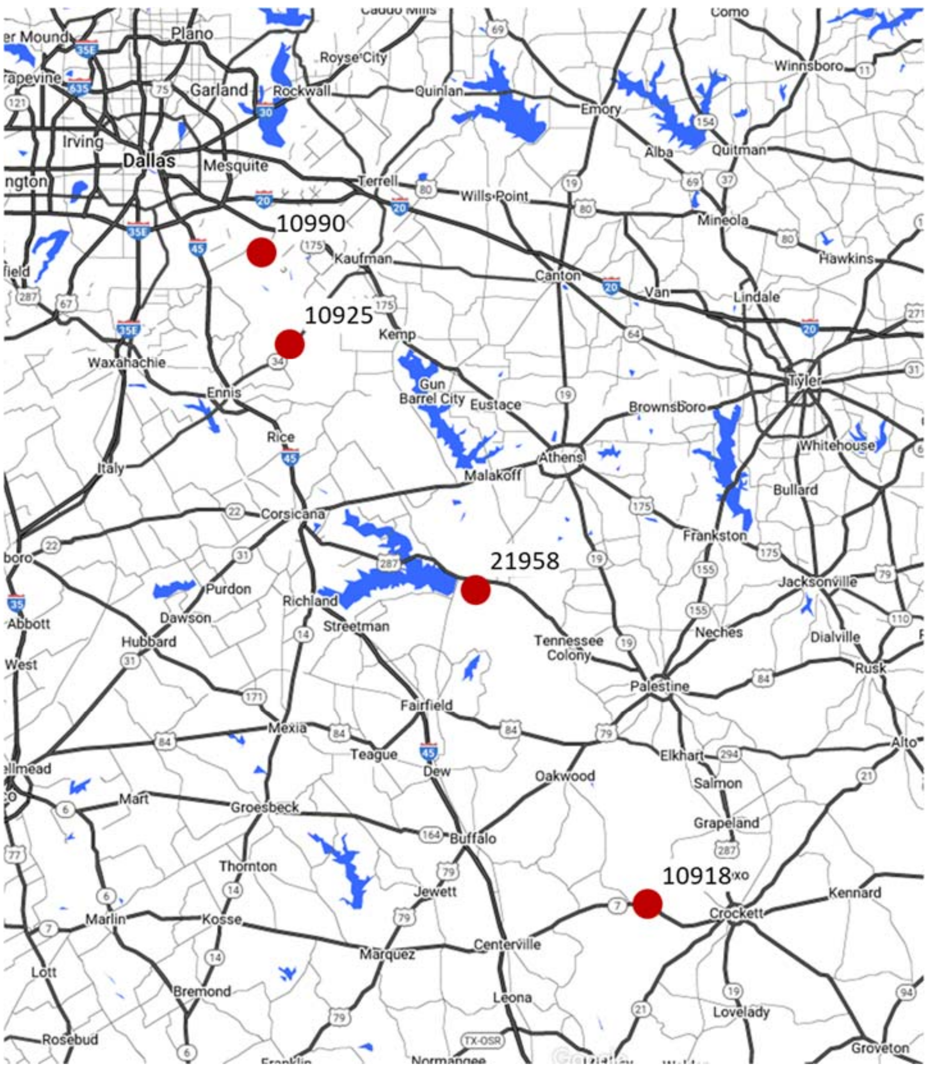

Figure 2: Middle Trinity 2017 sites.

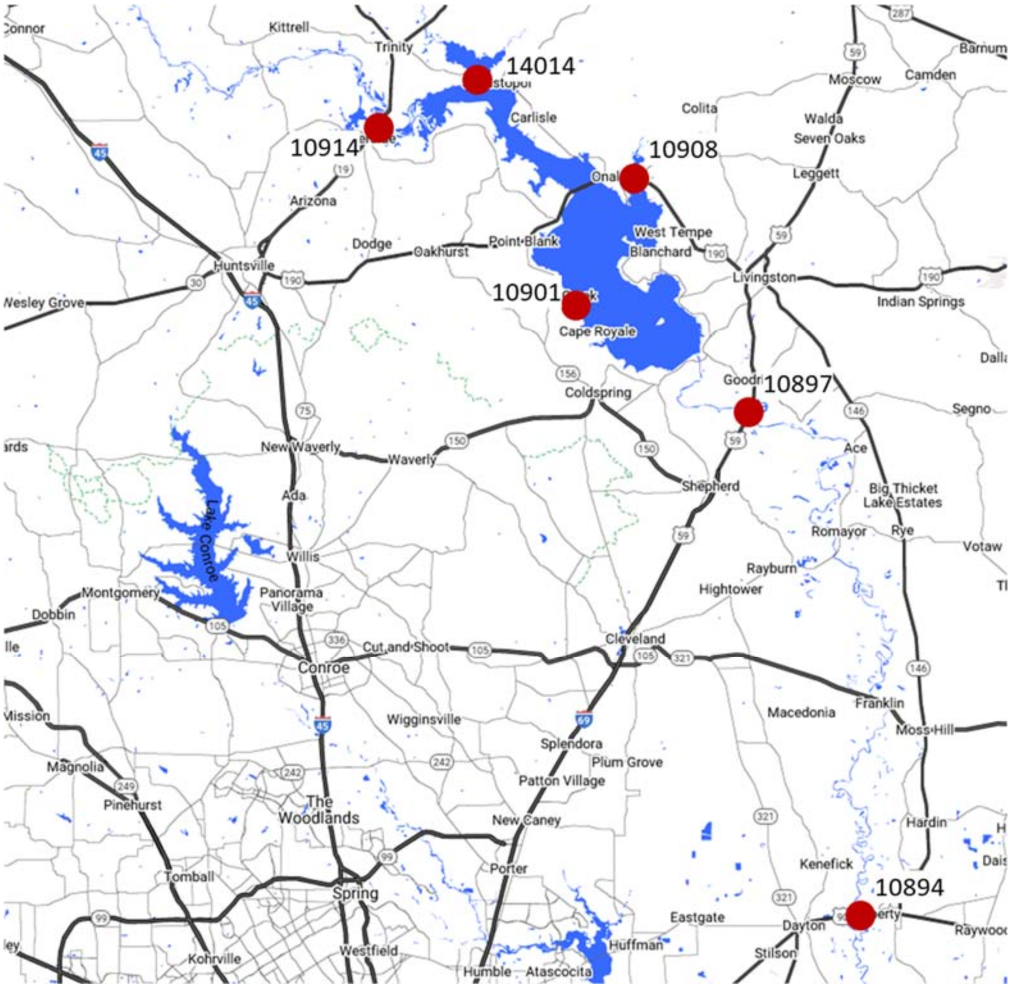

Figure 3: Lower Trinity 2017 sites.

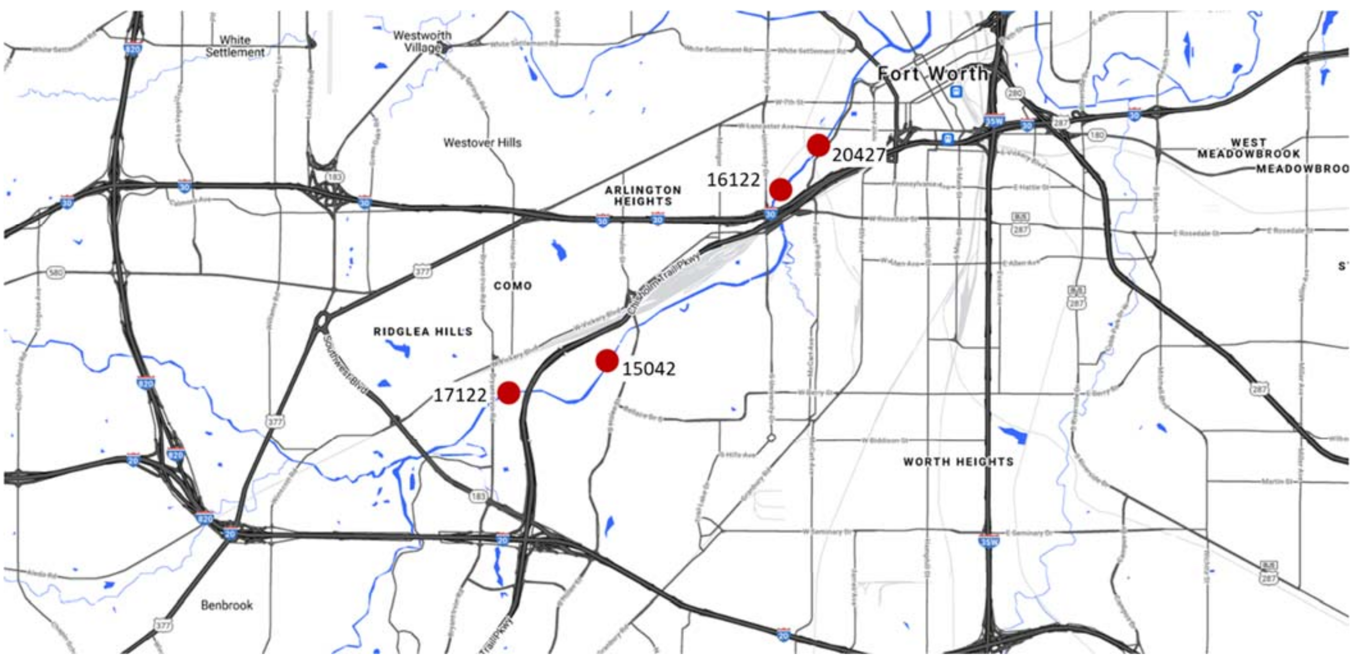

Figure 4: Fort Worth 2021 sites.

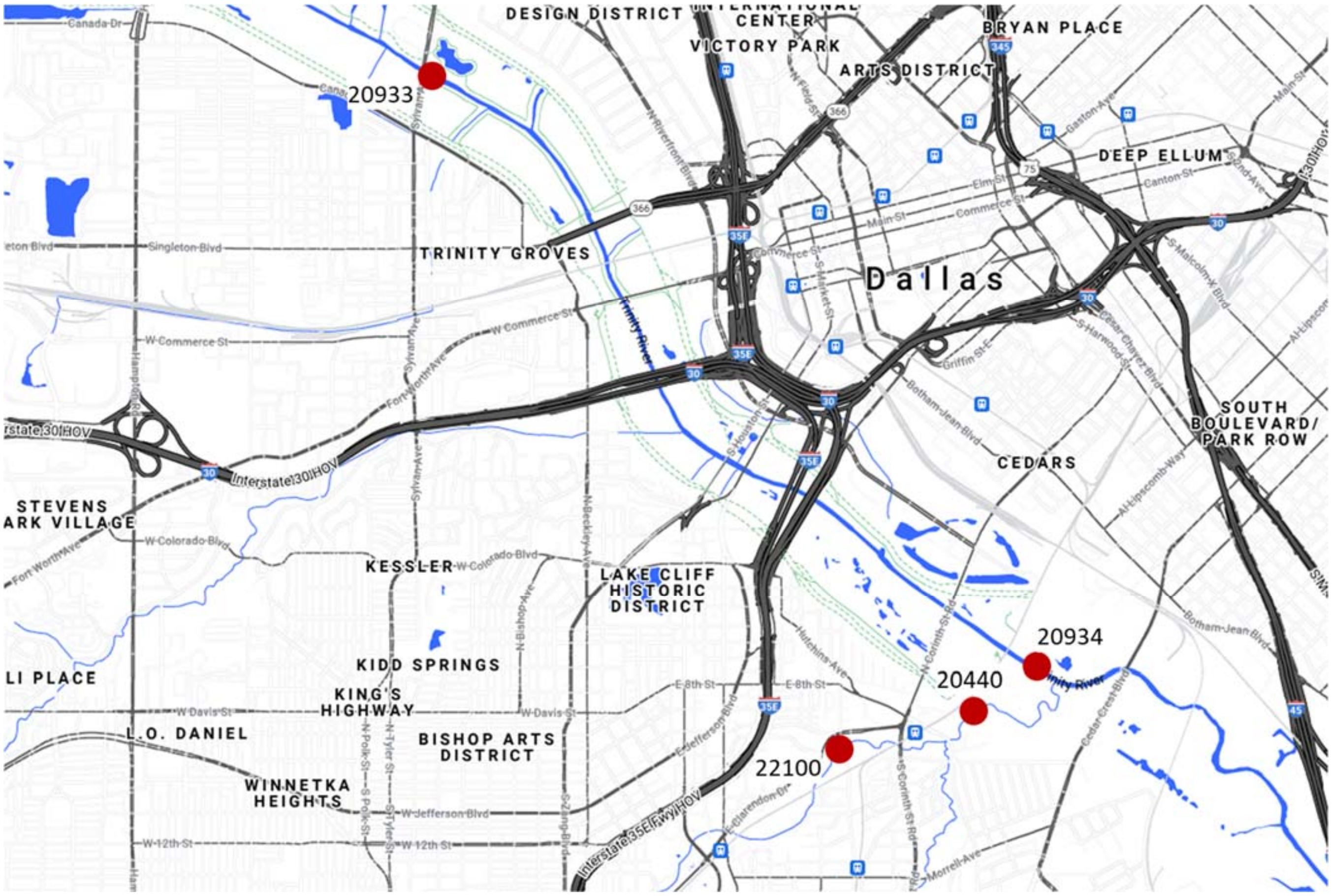

Figure 5: Dallas 2021 sites.

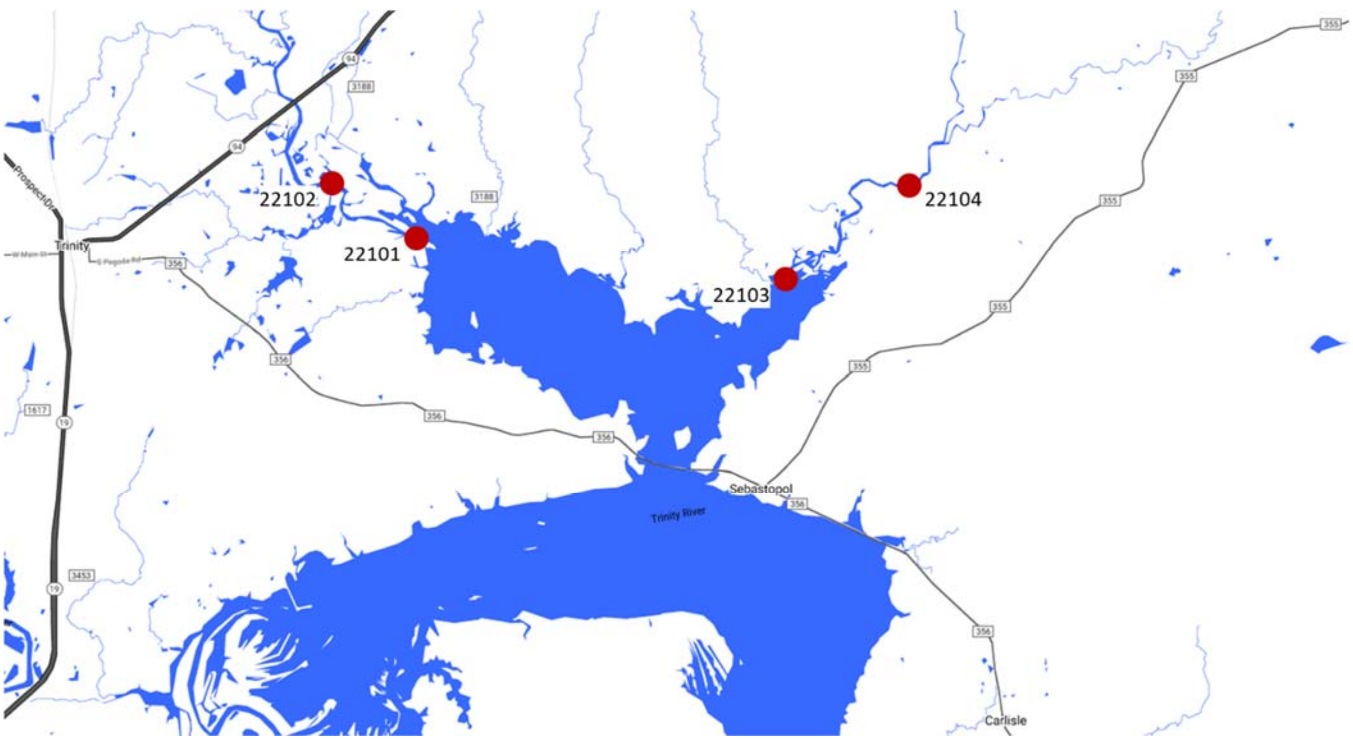

Figure 6: Lake Livingston 2021 Sites.

Methods

Field Parameters

At each site, field parameters were measured in the water column in addition to sediment samples being collected.

Basic Sediment Collection

Sediment samples were collected from all sites using either a dredge or a scoop. A scoop was used at any site that was wadeable and had velocities that were low enough to ensure that the fine sediments were not washed away while collecting the sample. One site which was wadeable required the use of the dredge because the sediments were being washed out of the scoop. All other sites that were not wadeable were sampled with a Ponar style dredge.

At all reservoir sites, a minimum of three dredge samples were collected. Due to the size of the dredge, sediment penetration was less than 3.5 inches and an anaerobic layer was not observed in any of the samples. At all river sites, a minimum of two dredge pulls were required to obtain enough material to fill all the sample containers.

All material collected at each site with either the scoop or dredge method was placed in a pan and homogenized before being scooped into the sample jars. The pans, scoops, and dredge were triple rinsed with water, sprayed with denatured alcohol and wiped with paper towels, and tripled rinsed with water again between each site. Samples were immediately placed in a cooler on ice.

Coring

Coring was conducted by staff with Arroyo Environmental Consultants, LLC. A boat with a custom built coring rig was used in conjunction with the SDI Vibecore system. The system includes a power head that vibrates a three-inch diameter, 10-foot long aluminum tube into the sediment (Figure 7). The tube is vibrated into the sediment and a vacuum is created with the sediment plug. A winch is used to pull the power head and tube back to the surface. Before the bottom of the tube emerges from the surface of the water, a cap is taped in place to prevent the sediments from spilling out of the bottom.

At each site, the tube was removed from the power head and the top of the sediment inside the tube was located using a Keson pocket rod and then the top of the tube was capped. The tubes were transported to the shore and processed. The tube was cut with a pipe cutter at the surface of the sediment. The remaining tube with the sediment was then cut into up to three sections depending on the depth of sediment penetration. Site 14014 (Lake Livingston at the mouth of the White Rock Creek cove) had 9.6 feet of penetration and was split into three sub-samples. Site 10908 (Lake Livingston near the outlet of Kickapoo Creek cove) had 4.6 feet of penetration and was split into two sub-samples. Site 10901 (Lake Livingston at the Wolf Creek cove outlet) had only 1.2 feet of penetration due to the density of the substrate and only one sample was taken from this core. Site 10914 (Lake Livingston headwaters at SH 19) proved to be a very difficult site to obtain a core sample. Several locations around this site had a very thin layer of sediment over a solid impenetrable layer that appeared to be either hardened clay or bedrock. After many attempts, only 0.7 feet of sediment could be collected. This volume did not provide enough material for both the PCBs/Dioxins/Furans and sediment conventionals analysis. It was determined in the field that the all the collected material would be used for PCB/Dioxin/Furan analysis. Further data analysis for this site will be completed using the sediment conventional results obtained from the surface dredge sample.

Sediments were removed from the tube and homogenized in a pan before being scooped into the sample jars. The pans and scoops were triple rinsed with water, sprayed with denatured alcohol and wiped with paper towels, and tripled rinsed with water again between each sub-sample. Samples were immediately placed in a cooler on ice.

Figure 7: SDI VibeCore system being used by Arroyo Environmental Consultants, LLC in Lake Livingston at site 10914.

Storage, Shipping, and Analysis

Samples were collected over several days. At the end of each day, samples were brought indoors and stored in coolers. The PCB/Dioxin/Furan samples were wrapped in aluminum foil before being placed in the coolers. Ice levels were maintained over the course of storage before samples were shipped overnight to the labs for analysis. Prior to shipping, the coolers were double lined with trash bags and packed with the pre-cooled samples and fresh ice.

PCBs, Dioxins, and Furans were analyzed by Eurofins Lancaster Laboratories Environmental, LLC in Lancaster, Pennsylvania. This consisted of the full suite of PCB, Dioxin, and Furan congeners. Some PCBs were grouped but a majority of the results were for the single congeners.

The sediment conventionals were analyzed by Ana-Lab Corporation in Kilgore, Texas. These conventionals included sediment particle size percentages (gravel, sand, silt, and clay), percent solids, and total organic carbon.

Results

Data analysis includes a review of the total PCB and total Dioxin/Furan levels in sediments at each of the 38 sites including the core samples at Lake Livingston in 2017 (Appendix A: PCB, Dioxin, and Furan Data).

Results of the core samples on Lake Livingston were not conclusive. The reservoir was impounded in 1969 and sediments would have encompassed the time period when PCBs were being manufactured, through the ban, and to present day. It was expected that concentrations of PCBs, dioxins, and furans would increase with depth. However, this was not consistently seen at all sites, with the exception being site 10908 in Kickapoo Creek Bay. Cores for stations 10914 at the headwaters of the reservoir and 10901 at Wolf Creek were very shallow due to impenetrable sediments below a softer surface layer. Therefore, the full core was used for these samples. The sample collected at the mouth of the White Rock Creek cove did not display any pattern. The sediments at this site were a very loose silt and clay. There is a narrow passage from the cove into the main body of the reservoir that had a detectable current during sampling. It is likely that the loose material and strong current at this station keeps the sediments mixed.

Results of the river and stream samples are summarized in the graph in Figure 8. A stick diagram of the river, streams, and reservoirs that were sampled is located below the graph. This diagram is not meant to indicate distances between sites, only their locations in hydrologic order along the sampled reach. Areas of the graph that are highlighted with a gray background represent stations that are on tributaries to the main run of the river or reservoir. The blue bars are the total PCB concentrations. The red and white bars represent the total dioxin and furan concentration adjusted for each congener’s toxic equivalency factor (TEF).

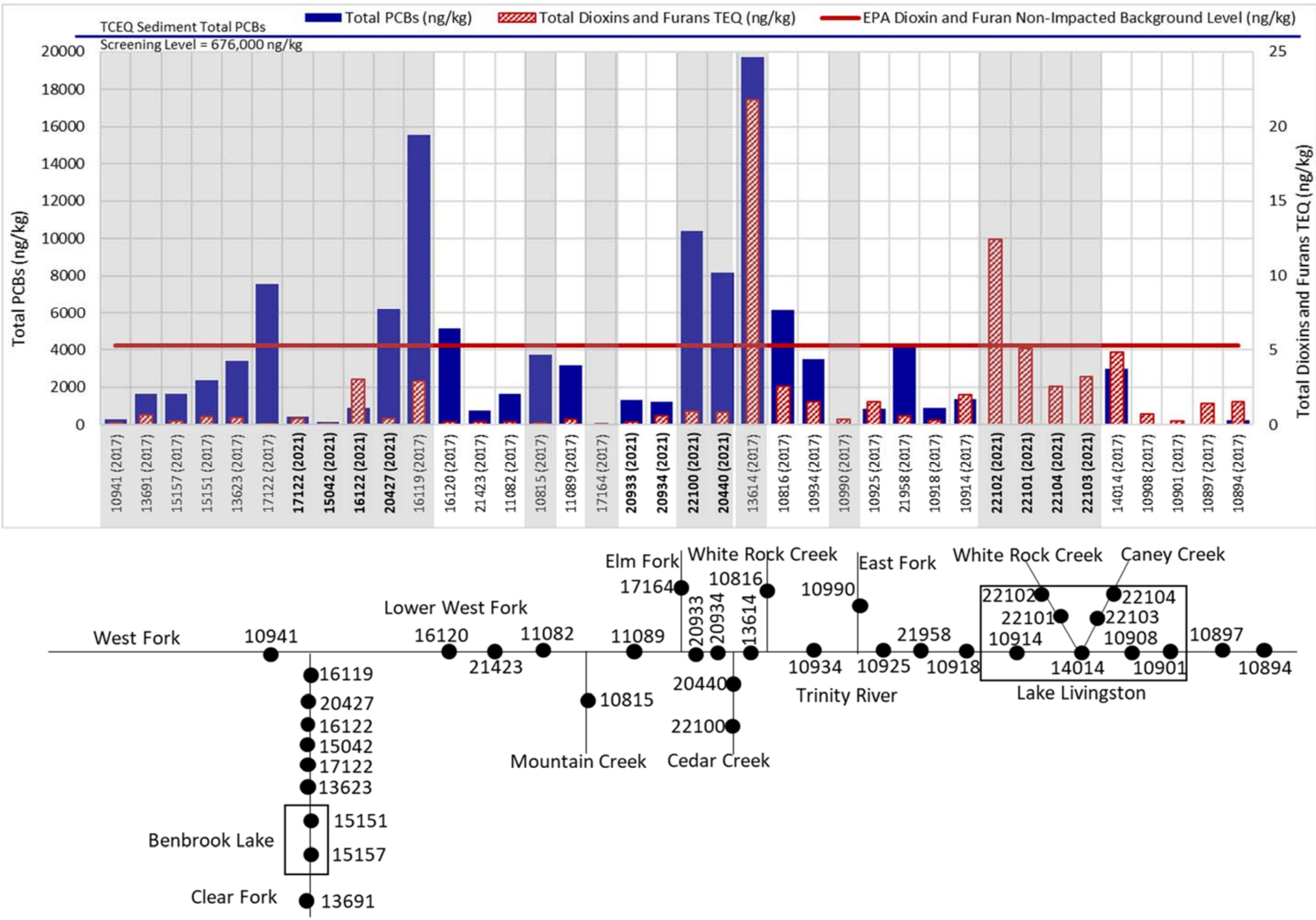

Figure 8: PCB, dioxin, and furan results.

The blue line above the graph is the TCEQ sediment screening level of 676,000 ng/kg. The red line represents the EPA dioxin and furan background level for non-impacted segments of 5.3 ng/kg. This value is based on the average concentration of the most recently deposited sediments at eleven lakes that have no known sources of dioxins and furans (Cleverly, et al., 1996).

As shown in Figure 8, PCB concentrations were well below the sediment screening level with the highest concentration being less than 20,000 ng/kg. However, there were increases in PCB levels seen along the Clear Fork Trinity River in Fort Worth, in Dallas between the Elm Fork Trinity River confluence and Cedar Crest Boulevard, and in the White Rock Creek cove of Lake Livingston based on data collected in 2017. Dioxin and furan concentrations also increased in these three areas. Station 13614 was the only site sampled in 2017 with dioxin and furan concentrations above the non-impacted background level.

Sampling in 2021 showed that there was a decrease in PCB concentrations seen at station 17122 in Fort Worth from 2017 to 2021. This seems to indicate that concentration changes over time may largely be a function of movement of bed sediments downstream. The highest concentration measured in the Clear Fork Trinity River for the 2021 sampling was observed at station 20427, approximately 5 miles downstream of station 17122. There was an increase in dioxin and furan concentration at station 16122 on the Clear Fork.

The 2021 sampling in Dallas indicate that PCB concentrations were elevated in Cedar Creek (stations 22100 and 20440). Dioxin and furan concentrations were slightly higher in this tributary than they were at the two sites on the main run of the river (stations 20933 and 20934) that are located upstream of the confluence of Cedar Creek with the Trinity River. However, the concentrations seen in 2021 were much lower than those seen in 2017 at station 13614 which is located just downstream of the Cedar Creek confluence.

2021 sample results for the White Rock Creek cove area of Lake Livingston did not indicate any PCB sources from the arms of this cove; White Rock Creek and Caney Creek. There were elevated concentrations of dioxins and furans at all four sites, however, the highest concentrations were observed at the upstream site on White Rock Creek indicating that a source in this portion of the watershed may have been responsible for the high levels observed in 2017.

Conclusions

Based on the results of this study, there are elevated levels of PCBs, dioxins, and furans in Fort Worth, Dallas, and the Lake Livingston White Rock Creek cove. When comparing the PCB, dioxin, and furan concentrations at each site to the most common components of Arochlor mixes for PCBs and various municipal and industrial activities for dioxins and furans, some potential sources stand out. Table 1 shows the homolog percentages of nine common Arochlor mixes (Battelle Memorial Institute, GeoChem Metrix Inc., U.S. Navy SPAWAR Systems Center, U.S. Environmental Protection Agency ORD, 2012). Table 2 shows the top seven dioxins and furans found in combustion and non-combustion sources of these contaminants (Cleverly, Schaum, Schweer, Becker, & Winters, 1997).

Most of the PCB homolog profiles in this study appeared to line up with Arochlor 1260 with several sites having profiles similar to Arochlor 1262, 1254, or 1248. Applications for these Arochlor mixes included transformers, hydraulic fluids, and plasticizers (Oregon Department of Environmental Quality, 2003) so their use was quite ubiquitous. It is important to note, however, that the PCB profiles may not be useful for identifying potential sources as these compounds degrade from higher to lower weight congeners over time; meaning that chlorine atoms are released. Since PCBs have been in the system for decades, the accuracy of comparisons between the homolog profile of fresh Aroclors and the profiles of the samples in this study are extremely limited.

Because dioxins and furans are by-products of current activities and processes, comparisons of these profiles may prove to be more accurate and useful. Unsurprisingly, the profiles at most of the sites are quite similar to the profile of diesel fuel combustion in trucks in the Baltimore Tunnel. Trains, semi-trailer trucks, box trucks, many models of personal vehicles, and large generators all run on diesel fuel. On the Clear Fork in Fort Worth, there was an increase in the dioxin and furan concentrations from station 15042 to 16122 in 2021. Station 15042 is located just upstream of a large rail yard adjacent to the river while station 16122 is just downstream of the rail yard. This indicates that the rail yard may be the major contributor of dioxins and furans in this portion of the river. It is interesting to note that the total concentrations and profiles at station 16122 in 2021 and station 16119 (downstream of 16122) in 2017 were very similar which indicates that the source of dioxins and furans at these two stations have been consistent over time.

There did not appear to be any major contributors of PCBs, dioxins, or furans through most of the watershed in Dallas. Concentrations of these contaminants were very low at the two stations leading in to Dallas – 11089 on the main stem of the river and 17164 on the Elm Fork Trinity River. However, there was a large spike at station 13614 which is located on the south side of Dallas based on the 2017 monitoring. The two main stem samples collected at stations 20933 and 20934 in 2021 show that there continued to be low concentrations of the contaminants moving down the main stem of the river. Two stations on Cedar Creek which confluences with the river immediately upstream of station 13614 showed relatively high levels of PCBs and slightly elevated levels of dioxins and furans. This information, combined with the fact that station 20934 on the main stem is immediately upstream of the Cedar Creek confluence, points to Cedar Creek being the source of contamination seen at station 13614. There are several small industrial areas located adjacent to Cedar Creek from IH-35 to the confluence with the Trinity River which may be contributing these contaminants to the stream.

There were elevated levels of PCBs, dioxins, and furans at the mouth of the White Rock Creek cove of Lake Livingston in 2017. Sampling conducted in the arms of the cove in 2021 did not reveal any PCBs entering the cove from the upstream watersheds. Dioxins and furans were found at relatively high levels in both arms as compared to the reservoir samples collected in 2017. The profiles for dioxins and furans were somewhat similar to both diesel fuel combustion and municipal waste incineration facilities with dry scrubbers. Based on surrounding land use, the area is largely rural. As stated above, diesel fuel combustion sources are ubiquitous. Additionally, residential trash burning is common in rural areas. Both of these factors could be contributing to the dioxins and furans seen in this portion of the reservoir.

This information will be provided to the appropriate officials at the cities of Fort Worth and Dallas, as well as, those in Trinity County. These officials may then determine if enforcement action is warranted.

Table 1: PCB homolog percentages of common Arochlor mixes.

Aroclor	A-1016	A-1221	A-1232	A-1242	A-1248	A-1254	A-1260	A-1262	A-1268
Homolog Group	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%	Wt%
Monochlorobiphenyl	0.7	60.1	27.5	0.7	<0.1	<0.1	<0.1	<0.1	0
Dichlorobiphenyl	17.5	33.4	26.8	15	1.1	0.2	<0.1	0.2	0
Trichlorobiphenyl	54.6	4.2	25.5	44.9	21.4	1.3	0.2	0.4	<0.1
Tetrachlorobiphenyl	22.1	1.2	10.6	20.3	32.9	10.2	0.4	0.5	0.1
Pentachlorobiphenyl	5.1	1.1	9.4	18.8	42.9	59.1	8.7	3.4	0.2
Hexachlorobiphenyl	0	0	0.2	0.3	1.6	26.8	43.2	26.4	4.4
Heptachlorobiphenyl	0	0	<0.1	0	<0.1	2.7	38.4	48.5	10.1
Octachlorobiphenyl	0	0	0	0	0	<0.1	8.3	19.7	45
Nonachlorobiphenyl	0	0	0	0	0	<0.1	0.7	1.6	35
Decachlorobiphenyl	0	0	0	0	0	0	0	0	4.8

Table 2: Top 7 congeners from combustion and non-combustion sources.

Dioxin & Furan Congeners	WHO 2005 TEF	**COMBUSTION**															**NON-COMBUSTION**		
		Municipal Waste Incineration Facilities With Hot-Sided Electrostatic Precipitators	Municipal Waste Incineration Facilities With Dry Scrubbers and Fabric Filters	Medical Waste Incinerators	Hazardous Waste Incinerators	Cement Kilns Burning Hazardous Waste	Cement Kilns Not Burning Hazardous Waste	Industrial Oil-Fired Boilers	Industrial/Utility Coal Combustors	Industrial/ Wood Combustors	Unleaded Fuel Combustion in Vehicles	Diesel Fuel Combustion in Trucks (tailpipe emissions)	Diesel Fuel Combustion in Trucks (Baltimore Tunnel)	Secondary Aluminum Smelters	Secondary Lead Smelters	Sewage Sludge Incinerators	Bleached Chlorine Paper Pulp	Technical Pentachlorophenol (Pesticide and disinfectants)	2,4-D Salts and Esters (Broadleaf Herbicide)
2,3,7,8-TCDD	1							**3**							**6**		**1**		
1,2,3,7,8-PeCDD	1																**3**		**2**
1,2,3,4,7,8-HxCDD	0.1							**6**									**7**		**6**
1,2,3,6,7,8-HxCDD	0.1																**7**		**3**
1,2,3,7,8,9-HxCDD	0.1												**5**				**7**		**7**
1,2,3,4,6,7,8-HpCDD	0.01	**3**	**2**	**4**		**4**	**3**	**5**	**6**	**5**	**4**	**4**	**2**	**5**		**3**	**6**	**3**	
OCDD	0.0003	**2**	**1**	**3**	**5**		**2**	**1**	**4**	**1**	**1**	**1**	**1**	**4**		**1**	**5**	**1**	
2,3,7,8-TCDF	0.1		**5**		**7**	**2**	**1**	**4**	**7**	**7**	**5**	**5**	**7**		**1**	**2**	**2**		
1,2,3,7,8-PeCDF	0.03					**5**				**7**	**6**				**4**				**4**
2,3,4,7,8-PeCDF	0.3					**1**	**5**		**5**	**7**				**3**	**2**	**6**	**4**		
1,2,3,4,7,8-HxCDF	0.1	**4**	**6**	**6**	**3**	**3**	**6**		**3**	**6**	**7**	**7**	**6**	**6**	**3**	**7**			**5**
1,2,3,6,7,8-HxCDF	0.1	**7**		**7**	**4**	**7**				**4**	**7**	**6**		**7**					
1,2,3,7,8,9-HxCDF	0.1																		
2,3,4,6,7,8-HxCDF	0.1	**6**	**7**	**5**	**6**	**6**									**7**				
1,2,3,4,6,7,8-HpCDF	0.01	**1**	**3**	**2**	**1**		**7**		**2**	**2**	**3**	**3**	**4**	**1**	**5**	**5**		**4**	**1**
1,2,3,4,7,8,9-HpCDF	0.01							**7**										**5**	
OCDF	0.0003	**5**	**4**	**1**	**2**		**4**	**2**	**1**	**3**	**2**	**2**	**3**	**2**		**4**		**2**	

References

Battelle Memorial Institute, GeoChem Metrix Inc., U.S. Navy SPAWAR Systems Center, U.S. Environmental Protection Agency ORD. (2012). *A Handbook for Determining the Sources of PCB Contamination in Sediments.* Port Hueneme, CA: NAVFAC Engineering and Expeditionary Warfare Center.

Cleverly, D., Monetti, M., Phillips, L., Cramer, P., Hait, M., McCarthy, S., . . . Winters, D. (1996). A Time-Trends Study Of The Occurrences And Levels Of CDDs, CDFs And Dioxin-Like PCBs In Sediment Cores From 11 Geographically Distributed Lakes In The U.S. *ORGANOHALOGEN COMPOUNDS*(28), 77-82.

Cleverly, D., Schaum, J., Schweer, G., Becker, J., & Winters, D. (1997). The Congener Profiles of Anthropogenic Sources of Chlorinated Dibenzo-p-Dioxins and Chlorinated Dibenzofurans in the United States. *Organohalogen Compounds, 32*, 430-435.

Dunbar, J. (2007). *Sediment Thickness from Coring and Acoustic Profiling, Lake Buchanan, Llano and Burnet Counties, TX.* Waco: Texas Water Development Board.

EPA. (2021, August 2). *Dioxin*. Retrieved from United States Environmental Protection Agency: https://www.epa.gov/dioxin

EPA. (2021, August 2). *Polychlorinated Biphenyls (PCBs)*. Retrieved from United States Environmental Protection Agency: https://www.epa.gov/pcbs/learn-about-polychlorinated-biphenyls-pcbs

Oregon Department of Environmental Quality. (2003, August 6). Retrieved from Oregon Department of Environmental Quality: https://www.oregon.gov/deq/FilterDocs/ph-SourcePCBs.pdf

TCEQ. (2012). *Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods (RG-415).* Austin: Texas Commission on Environmental Quality.

TxDSHS. (2021, August 2). *Fishing Advisories, Bans, and FAQs about Bodies of Water - Seafood and Aquatic Life*. Retrieved from Texas Departent of State Health Services: https://www.dshs.texas.gov/seafood/advisories-bans.aspx

Appendix A: PCB, Dioxin, and Furan Data

Station	WEST FORK TRINITY RIVER NEAR RIVER OAKS BLVD/SH 183	CLEAR FORK AT US 377 NEAR ALEDO	BENBROOK LAKE EAST OF LAKESHORE ESTATES	BENBROOK LAKE EAST END OF DAM	CLEAR FORK DOWNSTREAM OF BENBROOK DAM
Site ID	10941	13691	15157	15151	13623
Date	5/23/2017	8/18/2017	8/18/2017	8/18/2017	8/17/2017
Secchi Depth (m)	0.6	0.11	0.36	0.6	>0.6
Air Temperature (C)	20	25	25	25	28.5
Days Since Precipitation	<1	1	1	1	2
Water Temperature (C)	23.61	26.7	29.1	29.5	28.3
Specific Conductance (uS/cm)	390.7	484	324	321	362
pH (su)	7.36	7.9	7.7	8	7.2
Dissolved Oxygen (mg/L)	7.17	7.3	6.6	7.1	4.2
Depth of water column	1.80 ft	1.7 ft	25.7 ft	49.7 ft	4 inches
Depth of penetration	3.5 inches	<3.5 inches	2.5 inches	2.5 inches	1 inch
Method of collection	scoop	dredge	dredge	dredge	scoop
# of dredge or scoops	about 12	5	3	3	25
Thickness of aerobic layer	na	na	na	na	na
Sediment color	greenish grey	tan	brown	dark grey and tan	brown
Sediment texture	gravel	gravel	silt	fine silt	silt
Core upper level	na	na	na	na	na
Core lower level	na	na	na	na	na
% Solids in Sediment	81.6	76.3	55.3	35.9	42.6
Total Organic Carbon (mg/kg)	2270	5200	12000	24500	17000
% Gravel	53.4	36	<0.1	29.8	8.25
% Silt	2.49	8.9	45.9	31.8	31.9
% Clay	3.48	12.9	21	36.8	28.9
% Sand	94	78.2	33.1	31.4	39.1
Total Monochlorobiphenyls (ng/kg)	0.00	0.00	1.54	0.00	0.00
Total Dichlorobiphenyls (ng/kg)	8.83	14.61	10.70	12.00	27.42
Total Trichlorobiphenyls (ng/kg)	16.04	27.59	23.37	19.18	52.88
Total Tetrachlorobiphenyls (ng/kg)	59.26	243.70	285.39	417.30	459.45
Total Pentachlorobiphenyls (ng/kg)	50.20	273.78	296.06	402.85	629.85
Total Hexachlorobiphenyls (ng/kg)	88.89	530.09	516.09	763.09	1212.65
Total Heptachlorobiphenyls (ng/kg)	59.00	392.03	384.11	543.25	797.11
Total Octochlorobiphenyls (ng/kg)	17.82	126.09	110.75	147.88	188.22
Total Nonachlorobiphenyls (ng/kg)	3.79	31.80	24.86	30.42	31.30
Total Decachlorobiphenyls (ng/kg)	6.37	29.50	16.40	17.50	15.40
Total PCBs (ng/kg)	310.20	1669.19	1669.27	2353.47	3414.28
Total Dioxins (ng/kg)	14.88	175.59	64.69	167.77	102.99
Total Furans (ng/kg)	1.44	12.13	3.69	7.95	8.35
Total Dioxins and Furans (ng/kg)	16.32	187.72	68.38	175.72	111.34

Station	CLEAR FORK DOWNSTREAM OF BRYANT IRVIN ROAD	CLEAR FORK DOWNSTREAM OF BRYANT IRVIN ROAD	CLEAR FORK TRINITY RIVER UPSTREAM OF HULEN STREET	CLEAR FORK TRINITY RIVER AT IH 30
Site ID	17122	17122	15042	16122
Date	8/17/2017	7/7/2021	7/7/2021	7/7/2021
Secchi Depth (m)	0.47	0.29	0.31	0.31
Air Temperature (C)	31	29.4	31.7	32.8
Days Since Precipitation	2	1	1	1
Water Temperature (C)	28.6	25.3	26.3	27.9
Specific Conductance (uS/cm)	402	403	409	399
pH (su)	7.6	7.7	7.8	7.6
Dissolved Oxygen (mg/L)	9.6	8.3	9	8
Depth of water column	0.8 ft	1 m	0.7 m	1 m
Depth of penetration	0.15 ft	0.1 m	0.1 m	0.2 m
Method of collection	scoop	scoop	scoop	dredge
# of dredge or scoops	36	27	22	5
Thickness of aerobic layer	na	NA	NA	NA
Sediment color	grey	brown	brown	dark grey
Sediment texture	sand and gravel	sand	gravel	fines and sand
Core upper level	na	na	na	na
Core lower level	na	na	na	na
% Solids in Sediment	77.4	66.2	89.8	50.4
Total Organic Carbon (mg/kg)	1140	2400	<223	16600
% Gravel	54.3	13.1	64.2	3.02
% Silt	5.93	10.4	1.43	29.1
% Clay	8.89	8.68	2.14	27.1
% Sand	85.2	67.8	32.2	40.8
Total Monochlorobiphenyls (ng/kg)	5.80	0.00	0.00	0.00
Total Dichlorobiphenyls (ng/kg)	130.00	0.00	0.00	24.85
Total Trichlorobiphenyls (ng/kg)	246.16	38.74	13.68	121.64
Total Tetrachlorobiphenyls (ng/kg)	394.70	29.31	14.52	63.38
Total Pentachlorobiphenyls (ng/kg)	556.69	99.84	32.75	215.90
Total Hexachlorobiphenyls (ng/kg)	2553.51	139.71	58.97	274.87
Total Heptachlorobiphenyls (ng/kg)	2748.60	110.75	37.33	211.70
Total Octochlorobiphenyls (ng/kg)	809.50	0.00	0.00	13.90
Total Nonachlorobiphenyls (ng/kg)	71.42	0.00	0.00	0.00
Total Decachlorobiphenyls (ng/kg)	36.20	0.00	0.00	0.00
Total PCBs (ng/kg)	7552.58	418.35	157.25	926.24
Total Dioxins (ng/kg)	22.57	54.86	6.42	749.43
Total Furans (ng/kg)	1.63	4.45	0.91	65.84
Total Dioxins and Furans (ng/kg)	24.20	59.31	7.33	815.26

Station	CLEAR FORK TRINITY RIVER 2NEAR WEST LANCASTER AVENUE	CLEAR FORK TRINITY RIVER AT PURCEY STREET DRAIN	WEST FORK DOWNSTREAM OF HANDLEY EDERVILLE ROAD	WEST FORK TRINITY RIVER AT RIVER LEGACY PARK FOOTBRIDGE
Site ID	20427	16119	16120	21423
Date	7/7/2021	5/23/2017	8/17/2017	5/22/2017
Secchi Depth (m)	0.4	0.16	0.29	0.34
Air Temperature (C)	34.4	24	30.5	28
Days Since Precipitation	1	<1	2	<1
Water Temperature (C)	28.9	23.44	30.54	25.95
Specific Conductance (uS/cm)	388	361	292	736
pH (su)	8.1	7.53	8	7.14
Dissolved Oxygen (mg/L)	8.7	7.86	9.3	8.36
Depth of water column	0.5 m	6.2 ft	0.5 ft	2 ft
Depth of penetration	0.1 m	3.5 inches	0.05 ft	3.5 inches
Method of collection	scoop	dredge	scoop	dredge and scoop
# of dredge or scoops	24	9	26	3 dredge and about 12 scoops
Thickness of aerobic layer	NA	na	na	na
Sediment color	brown	dark greenish grey	tan	light olive brown
Sediment texture	gravel	gravel and sand silt predominant	clay with some sand	sand
Core upper level	na	na	na	na
Core lower level	na	na	na	na
% Solids in Sediment	94.3	74.1	73.2	77.6
Total Organic Carbon (mg/kg)	<212	5800	3840	3660
% Gravel	83.8	67.2	5.3	1.84
% Silt	<0.1	4.97	28.9	2
% Clay	0.974	7.95	32.9	5
% Sand	15.3	87.1	38.2	93
Total Monochlorobiphenyls (ng/kg)	0.00	130.85	0.00	0.00
Total Dichlorobiphenyls (ng/kg)	16.64	618.33	14.14	6.68
Total Trichlorobiphenyls (ng/kg)	155.82	2443.09	88.69	15.08
Total Tetrachlorobiphenyls (ng/kg)	594.17	5255.07	1033.30	42.91
Total Pentachlorobiphenyls (ng/kg)	1169.98	2891.10	793.14	68.94
Total Hexachlorobiphenyls (ng/kg)	2188.46	2351.91	1406.21	261.19
Total Heptachlorobiphenyls (ng/kg)	1644.68	1252.96	1313.71	280.57
Total Octochlorobiphenyls (ng/kg)	382.80	426.07	406.01	84.75
Total Nonachlorobiphenyls (ng/kg)	29.99	145.93	57.21	11.45
Total Decachlorobiphenyls (ng/kg)	11.00	41.80	22.80	5.99
Total PCBs (ng/kg)	6193.54	15557.11	5135.21	777.56
Total Dioxins (ng/kg)	31.01	818.99	15.94	26.38
Total Furans (ng/kg)	6.02	54.52	1.84	2.33
Total Dioxins and Furans (ng/kg)	37.03	873.51	17.79	28.72

Station	LOWER WEST FORK EAST OF LOWER TARRANT ROAD	MOUNTAIN CREEK AT SINGLETON ROAD	TRINITY RIVER NEAR WEST LOOP SH 12	ELM FORK TRINITY RIVER AT PROCTOR STREET	UPPER TRINITY RIVER AT SYLVAN AVENUE
Site ID	11082	10815	11089	17164	20933
Date	8/21/2017	8/21/2017	5/26/2017	5/24/2017	7/22/2021
Secchi Depth (m)	0.26	0.23	0.19	0.26	0.2
Air Temperature (C)	25	29	31	25	32
Days Since Precipitation	2	2	2	1	2
Water Temperature (C)	29.9	29.5	26.3	23.03	27.7
Specific Conductance (uS/cm)	687	426	694	527	471
pH (su)	7.3	7.2	7.79	7.86	7.5
Dissolved Oxygen (mg/L)	6.5	7.4	9.68	9.68	7.7
Depth of water column	0.8 ft	0.5 ft	0.35 ft	2.2 ft	1.1 m
Depth of penetration	0.25 ft	0.5 inches	0.15 ft	0.5 inches	0.06 m
Method of collection	scoop	scoop	scoop	scoop	dredge
# of dredge or scoops	21	45	12	67	8
Thickness of aerobic layer	na	na	na	na	NA
Sediment color	dark gray brown	tan	dark grayish brown	brown	brown
Sediment texture	clay	clay	sand	sticky clay	sand
Core upper level	na	na	na	na	na
Core lower level	na	na	na	na	na
% Solids in Sediment	69.4	55.6	72.5	64.3	72.1
Total Organic Carbon (mg/kg)	7680	4010	4830	3920	<277
% Gravel	4.23	5.43	<0.1	9.18	0.06
% Silt	19.7	34.9	13	23.9	8.09
% Clay	31.6	46.8	20	59.7	14.2
% Sand	48.7	18.3	67	16.4	78.7
Total Monochlorobiphenyls (ng/kg)	1.72	0.00	12.40	0.00	0.00
Total Dichlorobiphenyls (ng/kg)	21.36	74.31	171.87	10.70	0.00
Total Trichlorobiphenyls (ng/kg)	35.74	323.10	636.95	0.00	38.55
Total Tetrachlorobiphenyls (ng/kg)	252.33	776.18	736.74	0.00	61.40
Total Pentachlorobiphenyls (ng/kg)	280.48	1002.23	639.92	0.00	199.37
Total Hexachlorobiphenyls (ng/kg)	530.00	979.80	559.36	0.00	449.36
Total Heptachlorobiphenyls (ng/kg)	389.09	460.89	322.05	0.00	413.66
Total Octochlorobiphenyls (ng/kg)	108.66	112.79	88.09	0.00	151.10
Total Nonachlorobiphenyls (ng/kg)	29.60	20.19	15.40	0.00	15.60
Total Decachlorobiphenyls (ng/kg)	25.60	10.70	9.29	0.00	0.00
Total PCBs (ng/kg)	1674.58	3760.19	3192.07	10.70	1329.04
Total Dioxins (ng/kg)	37.17	17.50	102.86	25.52	52.62
Total Furans (ng/kg)	0.80	0.84	6.51	0.70	4.77
Total Dioxins and Furans (ng/kg)	37.97	18.35	109.37	26.22	57.39

Station	UPPER TRINITY RIVER AT SANTA FE AVENUE	CEDAR CREEK AT SOUTH MOORE STREET	CEDAR CREEK NEAR EAST 8TH STREET IN MOORE PARK	TRINITY RIVER UPSTREAM OF CEDAR CREST BLVD	WHITE ROCK CREEK AT US 175
Site ID	20934	22100	20440	13614	10816
Date	7/22/2021	7/22/2021	7/22/2021	8/21/2017	8/21/2017
Secchi Depth (m)	0.19	>0.6	>0.6	0.23	0.21
Air Temperature (C)	32	32	32	32	29.5
Days Since Precipitation	2	2	2	3	2
Water Temperature (C)	28	27.2	28	30.9	30.3
Specific Conductance (uS/cm)	471	584	595	621	305
pH (su)	7.2	8	7.4	7.6	7.4
Dissolved Oxygen (mg/L)	7.6	9.5	11	7.6	6.7
Depth of water column	1.2 m	0.15 m	0.1 m	2 meters	1.65 ft
Depth of penetration	0.03 m	0.1 m	0.1 m	2.5 inches	4 inches
Method of collection	dredge	scoop	scoop	dredge	scoop
# of dredge or scoops	9	15	23	9	7
Thickness of aerobic layer	NA	NA	NA	na	na
Sediment color	brown	light brown	brown	brown with organics	greyish brown
Sediment texture	sand	small gravel	small gravel	sand	sand and silt
Core upper level	na	na	na	na	na
Core lower level	na	na	na	na	na
% Solids in Sediment	74.8	88.8	79	70.6	58.1
Total Organic Carbon (mg/kg)	<267	<225	<253	5140	8490
% Gravel	0.75	54.9	26.9	1.71	0.37
% Silt	22.1	<0.1	<0.1	10.9	19
% Clay	14	2.71	4.39	17.9	39
% Sand	63.8	42.5	68.8	71.2	42.1
Total Monochlorobiphenyls (ng/kg)	0.00	0.00	0.00	13.16	13.26
Total Dichlorobiphenyls (ng/kg)	0.00	88.84	94.73	319.96	120.73
Total Trichlorobiphenyls (ng/kg)	46.72	1365.76	412.00	2426.12	389.17
Total Tetrachlorobiphenyls (ng/kg)	98.81	2703.21	1362.64	2800.33	829.36
Total Pentachlorobiphenyls (ng/kg)	192.30	3131.21	2526.25	3516.47	1267.55
Total Hexachlorobiphenyls (ng/kg)	435.48	1983.46	2184.79	5591.49	1924.25
Total Heptachlorobiphenyls (ng/kg)	367.83	826.70	1022.08	3613.43	1124.56
Total Octochlorobiphenyls (ng/kg)	81.15	191.29	291.20	1020.10	296.89
Total Nonachlorobiphenyls (ng/kg)	0.00	49.30	175.37	248.10	111.70
Total Decachlorobiphenyls (ng/kg)	0.00	30.00	83.90	154.00	64.20
Total PCBs (ng/kg)	1222.29	10369.77	8152.96	19703.16	6141.67
Total Dioxins (ng/kg)	46.68	117.39	77.87	15493.23	651.12
Total Furans (ng/kg)	5.25	7.83	7.11	1702.56	66.26
Total Dioxins and Furans (ng/kg)	51.93	125.22	84.97	17195.80	717.38

Station	TRINITY RIVER AT SOUTH LOOP SH 12	EAST FORK TRINITY RIVER AT FM 3039	TRINITY RIVER AT SH 34	TRINITY RIVER NEAR US 287	TRINITY RIVER AT SH 7	LAKE LIVINGSTON AT SH 19
Site ID	10934	10990	10925	21958	10918	10914
Date	5/24/2017	5/25/2017	5/25/2017	7/10/2017	7/5/2017	7/5/2017
Secchi Depth (m)	0.08	0.23	0.08	0.07	0.04	0.13
Air Temperature (C)	20	22	26	24	30	31
Days Since Precipitation	1	1	1	3	7	4
Water Temperature (C)	23	21.97	24.36	28.2	29.27	30.59
Specific Conductance (uS/cm)	548	625	641	295.1	288.4	356
pH (su)	7.51	7.5	7.54	7.5	7.67	7.47
Dissolved Oxygen (mg/L)	7.45	8.34	7.99	7.18	5.79	5.67
Depth of water column	6 ft	2.0 ft	3 ft	12 ft	65 cm	32 ft
Depth of penetration	3.5 inches	0.4 inches	3.5 inches	3.5 inches	0.3 ft	3 inches
Method of collection	dredge	scoop	dredge	dredge	scoop	dredge
# of dredge or scoops	13	10	2	3	38	6
Thickness of aerobic layer	na	na	na	na	na	na
Sediment color	dark greyish brown	grayish brown	dark greyish brown	brown	brown	dark grey
Sediment texture	sand and silt	clay	silt	silt	sand	silty with small balls of clay
Core upper level	na	na	na	na	na	na
Core lower level	na	na	na	na	na	na
% Solids in Sediment	72.2	62.5	60.1	58.9	77.5	57.5
Total Organic Carbon (mg/kg)	7730	9310	10300	6060	9070	3180
% Gravel	3.4	5.56	<0.1	<0.5	1.4	1.08
% Silt	17	27	37.8	36.9	9.99	23
% Clay	20.9	48	32.8	36.9	15	32
% Sand	62.1	25	29.4	26.3	75	45
Total Monochlorobiphenyls (ng/kg)	2.63	0.00	0.00	7.03	0.00	0.00
Total Dichlorobiphenyls (ng/kg)	34.72	9.87	19.94	91.58	45.31	0.00
Total Trichlorobiphenyls (ng/kg)	106.20	6.47	31.12	127.76	25.81	0.00
Total Tetrachlorobiphenyls (ng/kg)	207.68	0.00	60.06	235.92	42.19	19.80
Total Pentachlorobiphenyls (ng/kg)	815.59	4.56	170.44	637.20	120.90	196.90
Total Hexachlorobiphenyls (ng/kg)	1324.27	5.13	321.11	1470.91	310.29	588.30
Total Heptachlorobiphenyls (ng/kg)	744.38	0.00	206.42	1133.87	254.12	442.50
Total Octochlorobiphenyls (ng/kg)	182.49	0.00	49.16	342.28	73.76	85.50
Total Nonachlorobiphenyls (ng/kg)	39.28	0.00	8.04	59.95	12.10	24.90
Total Decachlorobiphenyls (ng/kg)	24.80	0.00	7.86	89.00	13.40	28.60
Total PCBs (ng/kg)	3482.04	26.03	874.15	4195.50	897.88	1386.50
Total Dioxins (ng/kg)	361.20	86.84	291.82	132.23	227.14	1143.27
Total Furans (ng/kg)	24.02	4.73	20.09	7.72	2.89	4.81
Total Dioxins and Furans (ng/kg)	385.22	91.57	311.90	139.95	230.04	1148.08

Station	LAKE LIVINGSTON AT SH 19	LAKE LIVINGSTON UPPER WHITE ROCK CREEK ARM	LAKE LIVINGSTON LOWER WHITE ROCK CREEK ARM	LAKE LIVINGSTON UPPER CANEY CREEK ARM	LAKE LIVINGSTON LOWER CANEY CREEK ARM
Site ID	10914	22102	22101	22104	22103
Date	na	7/9/2021	7/9/2021	7/9/2021	7/9/2021
Secchi Depth (m)	na	7/9/2021	7/9/2021	7/9/2021	7/9/2021
Air Temperature (C)	na	0.16	0.17	0.36	0.26
Days Since Precipitation	na	25.6	25.6	26	26
Water Temperature (C)	na	<1	<1	<1	<1
Specific Conductance (uS/cm)	na	28.9	27.8	28.4	29.3
pH (su)	na	285	295	722	331
Dissolved Oxygen (mg/L)	na	6.7	6.4	6.5	6.62
Depth of water column	33 ft	4.9	4.2	9	6
Depth of penetration	0.7 ft	2.4 m	1.8 m	3 m	5.5 m
Method of collection	core	0.1 m	0.2 m	0.2 m	0.1 m
# of dredge or scoops	na	dredge	dredge	dredge	dredge
Thickness of aerobic layer	na	11	7	6	8
Sediment color	dark grey	NA	0.25 m	NA	0.05 m
Sediment texture	sand	brown	brown	brown	brown and dark grey
Core upper level	0 ft	sand	sand	sand	sand
Core lower level	0.7 ft	na	na	na	na
% Solids in Sediment	na	na	na	na	na
Total Organic Carbon (mg/kg)	na	73.5	68	70	65.4
% Gravel	na	1770	4850	381	1970
% Silt	na	1.15	0.07	1.03	0.01
% Clay	na	5.92	40	5.93	<0.1
% Sand	na	3.95	12	3.96	4
Total Monochlorobiphenyls (ng/kg)	5.80	89	48	89.1	96
Total Dichlorobiphenyls (ng/kg)	63.24	0.00	0.00	0.00	0.00
Total Trichlorobiphenyls (ng/kg)	116.47	0.00	0.00	0.00	0.00
Total Tetrachlorobiphenyls (ng/kg)	242.91	0.00	0.00	0.00	0.00
Total Pentachlorobiphenyls (ng/kg)	644.84	0.00	0.00	0.00	0.00
Total Hexachlorobiphenyls (ng/kg)	999.89	0.00	0.00	0.00	0.00
Total Heptachlorobiphenyls (ng/kg)	906.30	0.00	0.00	0.00	0.00
Total Octochlorobiphenyls (ng/kg)	284.16	0.00	0.00	0.00	0.00
Total Nonachlorobiphenyls (ng/kg)	57.13	0.00	0.00	0.00	0.00
Total Decachlorobiphenyls (ng/kg)	46.80	0.00	0.00	0.00	0.00
Total PCBs (ng/kg)	3367.54	0.00	0.00	0.00	0.00
Total Dioxins (ng/kg)	840.45	0.00	0.00	0.00	0.00
Total Furans (ng/kg)	6.80	1314.13	1240.74	1018.00	825.77
Total Dioxins and Furans (ng/kg)	847.25	3.31	3.11	0.67	1.60

Station	LAKE LIVINGSTON AT MOUTH OF WHITE ROCK CREEK COVE	LAKE LIVINGSTON AT MOUTH OF WHITE ROCK CREEK COVE	LAKE LIVINGSTON AT MOUTH OF WHITE ROCK CREEK COVE	LAKE LIVINGSTON AT MOUTH OF WHITE ROCK CREEK COVE	LAKE LIVINGSTON IN KICKAPOO CREEK BAY
Site ID	14014	14014	14014	14014	10908
Date	7/5/2017	na	na	na	7/6/2017
Secchi Depth (m)	0.11	na	na	na	0.28
Air Temperature (C)	31	na	na	na	27
Days Since Precipitation	4	na	na	na	1
Water Temperature (C)	33.3	na	na	na	33.052
Specific Conductance (uS/cm)	345.5	na	na	na	331.2
pH (su)	8.28	na	na	na	8.7
Dissolved Oxygen (mg/L)	9.25	na	na	na	9.79
Depth of water column	30.9 ft	30.9 ft	30.9 ft	30.9 ft	13.3 ft
Depth of penetration	< 3.5 inches	10 ft	10 ft	10 ft	< 3.5 inches
Method of collection	dredge	core	core	core	dredge
# of dredge or scoops	3	na	na	na	4
Thickness of aerobic layer	na	na	na	na	na
Sediment color	greyish tan	grey	grey	grey	dark grey
Sediment texture	fluffy silt	silt	silt	silt	sand
Core upper level	na	0 ft	3.6 ft	7.2 ft	na
Core lower level	na	2.4 ft	6.0 ft	9.6 ft	na
% Solids in Sediment	33.3	53.7	53.7	51.4	71.3
Total Organic Carbon (mg/kg)	9610	15600	12400	17100	4450
% Gravel	18.4	18.7	16.9	7.83	<0.5
% Silt	25.8	22.6	20	18	<1
% Clay	60.6	58.1	53	46.9	4.45
% Sand	13.6	19.3	27	35.1	95.5
Total Monochlorobiphenyls (ng/kg)	13.28	0.00	6.10	5.40	0.00
Total Dichlorobiphenyls (ng/kg)	106.30	0.00	117.30	67.00	0.00
Total Trichlorobiphenyls (ng/kg)	129.85	0.00	300.11	110.80	0.00
Total Tetrachlorobiphenyls (ng/kg)	187.01	0.00	948.43	236.45	0.00
Total Pentachlorobiphenyls (ng/kg)	518.12	0.00	2042.89	625.57	0.00
Total Hexachlorobiphenyls (ng/kg)	1055.59	0.00	2768.52	1157.48	0.00
Total Heptachlorobiphenyls (ng/kg)	601.49	0.00	1562.45	813.91	0.00
Total Octochlorobiphenyls (ng/kg)	264.50	0.00	452.15	250.89	0.00
Total Nonachlorobiphenyls (ng/kg)	61.10	0.00	68.71	47.70	0.00
Total Decachlorobiphenyls (ng/kg)	40.40	0.00	48.20	38.00	0.00
Total PCBs (ng/kg)	2977.64	0.00	8314.86	3353.20	0.00
Total Dioxins (ng/kg)	2385.51	3000.20	4568.98	2499.43	410.67
Total Furans (ng/kg)	12.90	14.42	28.81	14.30	1.93
Total Dioxins and Furans (ng/kg)	2398.41	3014.62	4597.79	2513.73	412.60

Station	LAKE LIVINGSTON IN KICKAPOO CREEK BAY	LAKE LIVINGSTON IN KICKAPOO CREEK BAY	LAKE LIVINGSTON AT WOLF CREEK CONFLUENCE	LAKE LIVINGSTON AT WOLF CREEK CONFLUENCE	TRINITY RIVER AT US 59
Site ID	10908	10908	10901	10901	10897
Date	na	na	7/6/2017	na	7/6/2017
Secchi Depth (m)	na	na	0.32	na	0.52
Air Temperature (C)	na	na	30	na	29
Days Since Precipitation	na	na	1	na	1
Water Temperature (C)	na	na	31.99	na	28.37
Specific Conductance (uS/cm)	na	na	356.9	na	366.2
pH (su)	na	na	8.63	na	7.32
Dissolved Oxygen (mg/L)	na	na	11.26	na	7.63
Depth of water column	11 ft	11 ft	8.4 ft	6.1 ft	12.9 ft
Depth of penetration	4.6 ft	4.6 ft	2 inches	1.2 ft	< 3.5 inches
Method of collection	core	core	dredge	core	dredge
# of dredge or scoops	na	na	5	na	5
Thickness of aerobic layer	na	na	na	na	na
Sediment color	tan	tan	tan brown	dark grey	brownish grey with some red sand
Sediment texture	sand	sand	sand some silt	hard pack sand	sand and fine gravel some silt
Core upper level	2.3 ft	0 ft	na	0 ft	na
Core lower level	4.6 ft	2.3 ft	na	1.2 ft	na
% Solids in Sediment	78.3	72.6	72.3	80.8	65.7
Total Organic Carbon (mg/kg)	1800	2700	1940	1230	3940
% Gravel	<0.5	<0.5	<0.5	<0.5	3.83
% Silt	13	2.5	<1	<1	7.93
% Clay	13	5.5	1.99	2.5	12.9
% Sand	74	92	98	97.5	79.2
Total Monochlorobiphenyls (ng/kg)	0.00	0.00	0.00	0.00	0.00
Total Dichlorobiphenyls (ng/kg)	19.40	13.90	12.10	0.00	0.00
Total Trichlorobiphenyls (ng/kg)	0.00	0.00	0.00	17.64	0.00
Total Tetrachlorobiphenyls (ng/kg)	0.00	0.00	0.00	470.06	0.00
Total Pentachlorobiphenyls (ng/kg)	0.00	0.00	0.00	464.80	0.00
Total Hexachlorobiphenyls (ng/kg)	0.00	0.00	0.00	911.28	0.00
Total Heptachlorobiphenyls (ng/kg)	0.00	0.00	1.57	610.64	21.10
Total Octochlorobiphenyls (ng/kg)	0.00	0.00	0.00	155.58	0.00
Total Nonachlorobiphenyls (ng/kg)	0.00	0.00	0.00	25.41	0.00
Total Decachlorobiphenyls (ng/kg)	5.15	4.87	5.05	14.00	0.00
Total PCBs (ng/kg)	24.55	18.77	18.72	2669.41	21.10
Total Dioxins (ng/kg)	696.69	1216.10	179.01	95.59	1508.86
Total Furans (ng/kg)	2.65	0.34	0.68	0.58	3.64
Total Dioxins and Furans (ng/kg)	699.35	1216.44	179.69	96.17	1512.50

Station	TRINITY RIVER AT US 90
Site ID	10894
Date	7/6/2017
Secchi Depth (m)	0.27
Air Temperature (C)	25
Days Since Precipitation	1
Water Temperature (C)	30.346
Specific Conductance (uS/cm)	361.7
pH (su)	8.29
Dissolved Oxygen (mg/L)	8.74
Depth of water column	4 ft
Depth of penetration	< 3.5 inches
Method of collection	dredge
# of dredge or scoops	3
Thickness of aerobic layer	na
Sediment color	tan
Sediment texture	sand
Core upper level	na
Core lower level	na
% Solids in Sediment	66.2
Total Organic Carbon (mg/kg)	4590
% Gravel	<0.5
% Silt	18.9
% Clay	18.9
% Sand	62.2
Total Monochlorobiphenyls (ng/kg)	0.00
Total Dichlorobiphenyls (ng/kg)	30.65
Total Trichlorobiphenyls (ng/kg)	52.93
Total Tetrachlorobiphenyls (ng/kg)	67.80
Total Pentachlorobiphenyls (ng/kg)	19.61
Total Hexachlorobiphenyls (ng/kg)	28.94
Total Heptachlorobiphenyls (ng/kg)	30.76
Total Octochlorobiphenyls (ng/kg)	5.90
Total Nonachlorobiphenyls (ng/kg)	0.00
Total Decachlorobiphenyls (ng/kg)	6.43
Total PCBs (ng/kg)	243.02
Total Dioxins (ng/kg)	1694.92
Total Furans (ng/kg)	2.04
Total Dioxins and Furans (ng/kg)	1696.96