

**Total Maximum Daily Loads for PCBs
in the Houston Ship Channel**

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**Quarterly Report 3
Draft**

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1. INTRODUCTION

Polychlorinated biphenyls (PCBs) are widespread organic contaminants that are environmentally persistent and can be harmful to human health even at low concentrations. A major route of exposure for PCBs worldwide is through food consumption, and this route is especially significant in seafood. The discovery of PCBs in seafood tissue has led the Texas Department of State Health Services to issue seafood consumption advisories, and some of these advisories have been issued for the Houston Ship Channel (HSC). Two specific advisories have been issued recently for all finfish species based on concentrations of PCBs, organochlorine pesticides, and dioxins. ADV-20 was issued in October 2001 and includes the HSC upstream of the Lynchburg Ferry crossing and all contiguous waters, including the San Jacinto River Tidal below the U.S. Highway 90 Bridge. ADV-28 was issued in January 2005 for Upper Galveston Bay (UGB) and the HSC and all contiguous waters north of a line drawn from Red Bluff Point to Five Mile Cut Marker to Houston Point. These two advisories represent a large surface water system for which TMDLs need to be developed and implemented. The overall purpose of this project is to develop a total maximum daily load (TMDL) allocation for PCBs in the Houston Ship Channel System, including upper Galveston Bay, and establish a plan for managing PCBs to correct existing water quality impairments and maintain good water quality in the future.

This report represents the third quarterly report for WO19 in FY08. Tasks to be completed in this work order include QAPP development (monitoring and modeling), monitoring and data collection, data evaluation, and additional data gathering for the Houston Ship Channel system. Efforts in the past quarter have focused on monitoring and data collection since approval was received from TCEQ for both the monitoring and modeling QAPPs.

2. MONITORING AND DATA COLLECTION

This task encompasses monitoring and sampling activities to assess current levels of PCBs in the Houston Ship Channel (HSC) system. This section summarizes the progress made between March 1, 2008 and May 31, 2008 regarding sampling activities. The 2008 sampling event was initiated in April and is currently ongoing. To date, 34 water-sampling locations, 25 sediment-sampling locations, 26 locations for fish tissue, have been sampled. A description of the methods and technical approach undertaken to accomplish the sampling task is presented below. All the sampling and analysis procedures used followed the approved project QAPP.

2.1 Assessment of Current Levels and Trends of PCBs in the Houston Ship Channel

The main purpose of this sampling task is to assess the severity, spatial and temporal extent of the current PCB contamination and compare that to historical levels for the segments of interest. More specifically, the goals are: (i) to use the data results to verify whether PCB concentrations are above the criteria and where, and/or how much PCB levels must decline to meet the criteria, (ii) to identify historical increases and declines in PCB levels that may be related to changes in sources over time, and (iii) to characterize other segments/waterbodies, such as the side bays, where PCB levels have not been previously measured.

As mentioned previously, 25 locations have been sampled for sediments, 34 locations for ambient water, 26 locations for fish tissue (Table 1). Samples were sent to the project laboratories to be analyzed for (i) PCB congeners, TSS, DOC, TPH, and POC in water (ii) PCB

congeners, TOC, TPH, Grain size and Solids content in sediment and (iii) PCB congeners in tissue.

Table 1 Summary of samples collected during the quarter

Matrix		Spring 2008		
		# of sites	QC samples*	Total # of samples
Water	XAD column	34	5	39
	GFF	34	5	39
In-stream sediment		25	5	30
Fish tissue	Cat fish	26	5	31
	Trout/Croaker	10	3	13

* QC samples include field duplicates, field blanks and recovery columns specified in the QAPP.

The following sections present a detailed summary of the sampled sites and media during Spring 2008.

2.1.1 In-stream Water Quality Sampling

Since PCB concentrations in water are significantly lower than the analytical detection limit, water sampling was conducted using the high-volume technique. Using this technique allows concentrating PCBs from large volumes of water to obtain measurable quantities. The high-volume system uses a stainless steel column packed with hydrophobic polymeric resin beads through which large volumes of water can be passed. Because PCBs are very hydrophobic, they rapidly sorb to the resin, making it possible to completely collect the dissolved PCBs from the sampled water. The PCBs can then be recovered from the resin by extraction with a non-polar organic solvent in the laboratory. PCBs associated with suspended particulates are collected on a 1 µm filter that is also extracted in the laboratory. For this TMDL, a

commercially-available Infiltrax 300 high-volume sampling system is being used. The Infiltrax 300 system is primarily comprised of the following components:

- An in-line pre-filter (140 μm) to remove debris and plankton larger than 140 μm that has the capability to foul the system and damage the pump head;
- A stainless steel positive displacement pump;
- Glass fiber filter cartridges (1 μm effective pore size);
- A pressure gauge on the filter cartridge to help in preventing the filter from clogging;
- XAD-2 resin column;
- A digital display unit displaying the pumping rate.

Water sampling was conducted at three different depths (2 ft from bottom, middle, and 1ft from top) as per the QAPP. A pumping rate of 1.1 ± 0.1 L/min was selected so that a target volume of 200 L was attained in 3 hours. A total of 34 locations in the main channel have been sampled to determine PCB levels in water (dissolved and suspended) during this quarter. Figure 1 shows the locations of the sampled stations. Table 2 includes a description of the sampled sites and the sites to be sampled. In addition to collecting the glass filter and XAD resin at each location, water samples composited by depth as specified in the QAPP were collected for TSS, DOC, TPH, and POC analyses. Field probe parameters (i.e., pH, temperature, conductivity, and salinity) were obtained using a YSI sonde (YSI 600-XLM).

Table 2 Summary of water, sediment, and tissue sampling

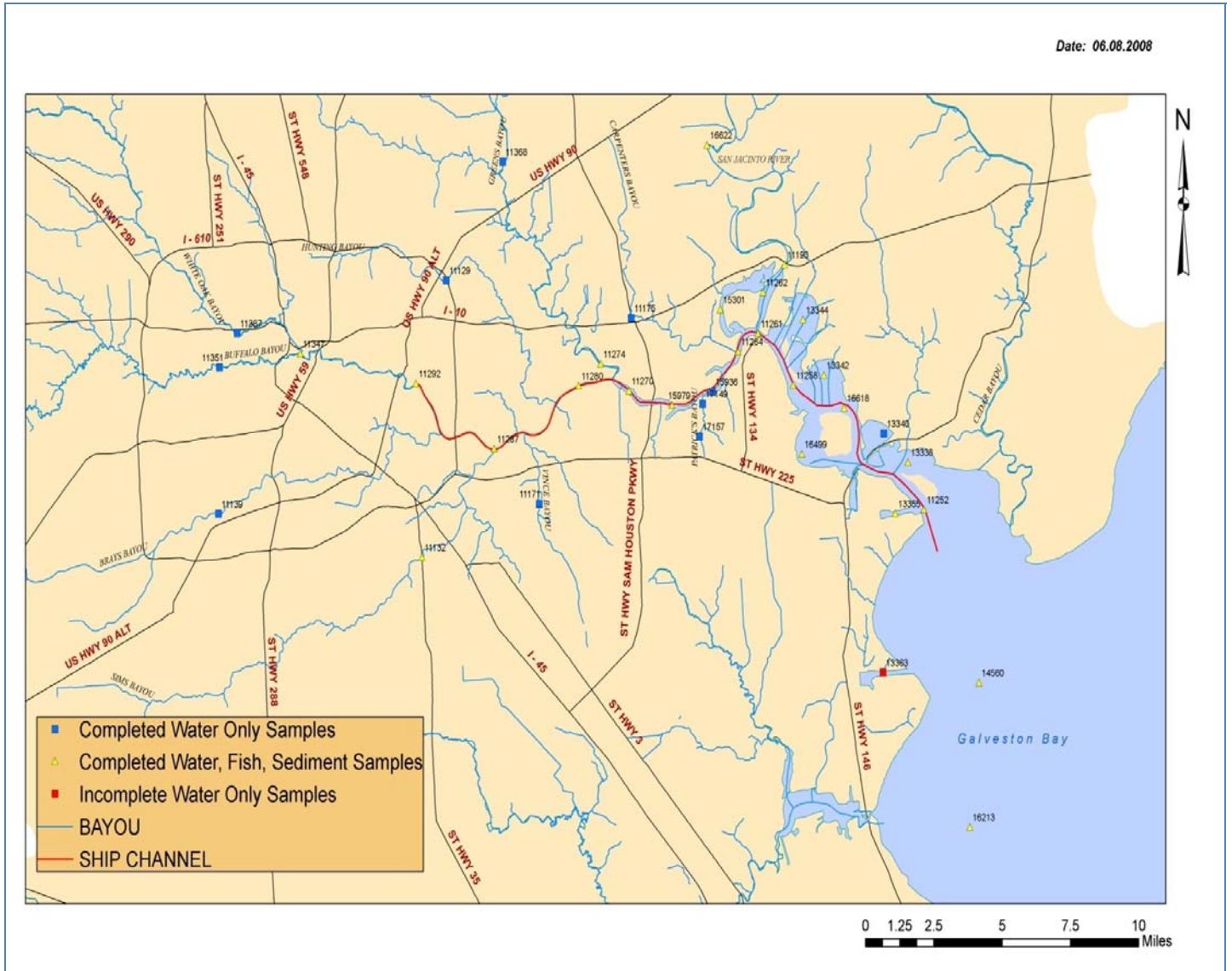
Segment	Site description	Station ID	Samples to be collected as per QAPP			Samples collected during Spring 2008			
			Water	Sediment	Fish	Water	Sediment	Fish (F1)	Fish (F2)
1007	Buffalo Bayou at Sheppard Dr. (USGS 08074000)--Replaced by Station TBD5	11351	x						
1007	Whiteoak Bayou at Heights Blvd	11387	x			√			
1007	Buffalo Bayou Tidal at Main St.	11347	x	x	x	√	√	√	O
1007	Houston Ship Channel/Buffalo Bayou in middle of Turning Basin	11292	x	x	x	√	√	√	O
1007	Brays Bayou at South Main St.	11139	x			√			
1007	Sims Bayou at Telephone Rd (USGS 08075500)	11132	x	x	x	√	√	√	O
1007	Houston Ship Channel/Buffalo Bayou at Confluence with Sims Bayou	11287	x	x	x	√	√	√	O
1007	Vince Bayou at W. Ellaine St. (USGS 08075730)	11171	x			√			
1007	Hunting Bayou at North Loop East (IH 610) --Replaced by Station TBD6	11129	x						
1007	Small ditch discharging to Hunting Bayou	TBD-1	x			*			
1007	Houston Ship Channel/Buffalo Bayou at Armco Steel Corporation Intake Screens	11280	x	x	x	√	√	√	O
1006	Greens Bayou at Brock Park	11368	x			√			
1006	Greens Bayou Tidal at Mechling Barge Lines. Alternatively, Greens Bayou at ISK Biosciences Ditch (station 16981)	11274	x	x	x	√	√	√	O
1006	Houston Ship Channel at CM 150	11270	x	x	x	√	√	√	√
1006	Houston Ship Channel at Shell Barge Cut, 0.9 mi. downstream of Beltway 8	15979	x	x	x	√	√	√ (Dup)	O
1006	HSC at OxyChem Ditch (005/004)	15936	x			√		√ (Dup)	O
1006	Carpenters Bayou Immediately Upstream of Loop 8 (Beltway) or a Freshwater Location TBD -- Replaced by Station TBD7	11175	x						
1006	Patrick Bayou Upstream of Tidal Rd	17149	x			*			
1006	Patrick Bayou xxx	17157	x			*			
1006	Houston Ship Channel at at San Jacinto Park, West of Battleship Texas	11264	x	x	x	√	√	√	√
1001	San Jacinto River Tidal at Banana Bend Road at end of pavement in Houston	16622	x	x	x	√	√	√	O
1001	San Jacinto River Tidal IH 10 Bridge East of Channelview	11193	x	x	x	√	√ (Dup)	√	O
1005	Old River Tidal/HSC at Old River Ship Building, Near Lakeside Dr and N Shore Dr	15301	x	x	x	√	√ (Dup)	√	O
1005	HSC Between Lynchburg Ferry and IH-10, 121m S AND 1.27km W of Lynchburg Rd and Lakeview Dr	11262	x	x	x	√ (Dup)	√	√	√

Segment	Site description	Station ID	Samples to be collected as per QAPP			Samples collected during Spring 2008			
			Water	Sediment	Fish	Water	Sediment	Fish (F1)	Fish (F2)
1005	Houston Ship Channel San Jacinto River at Lynchburg Ferry	11261	x	x	x	√	√	√	O
1005	Burnett Bay at Mid-Bay	13344	x	x	x	√ (Dup)	√	√	O
1005	Houston Ship Channel at CM 120	11258	x	x	x	√	√ (Dup)	√ (Dup)	√
1005	Scott Bay at Mid-Bay	13342	x	x	x	√	√	√	O
1005	Houston Ship Channel/San Jacinto River West of Exxon Docks and North of Alexander Island	16618	x	x	x	√	√	√	√
1005	San Jacinto Bay 200 yds SW of CM25 (98GB007)	16499	x	x	x	√	√	√	O
1005	Black Duck Bay at Mid-Bay	13340	x			√			
1005	Tabbs Bay Midway Between Goose Creek and Upper Hog Island	13338	x	x	x	√ (Dup)	√	√	√
1005	Barbours Cut mid-way between mouth And terminus	13355	x	x	x	√	√	√	√
1005	Houston Ship Channel at CM 91, Morgan's Point	11252	x	x	x	√	√	√	O
2421	Cedar Bayou non-tidal	TBD-2	x			√			
2421	Upper Galveston Bay at HSC Marker 75	14560	x	x	x	√	√	√	√
2421	Bayport Channel mid-way between mouth and terminus	13363	x	x	x	*	√	√ (Dup)	√
2421	Upper Galveston Bay at 97GB019, 5.25mi north of the HL&P P. H. Robinson Outfall	16213	x	x	x	√	√	√	√
1005	Small ditch to obtain a direct runoff concentration in the eastern part of the channel	TBD-3	x			*			
1006	Small ditch to obtain a direct runoff concentration in the eastern part of the channel	TBD-4	x			*			
1007	Buffalo Bayou at Tinsley Park	TBD5	x			√			
1007	Hunting at Wallisville	TBD6	x			√			
1006	Carpenters at Wallisville	TBD7	x			√			

Notes:

- 1) x indicates the samples that were planned to be collected per QAPP.
- 2) √ indicates successful sample collection; O indicates that fish was not caught on both nets on the sampling day; * indicates samples to be collected in the next quarter.
- 3) Red colored row indicates that the station was replaced with a new station due to access issues.
- 4) F1 stands for catfish; F2 stands for trout/croaker.
- 5) Dup indicates duplicate collected on the sampling day.
- 6) Filter from 13363 was not sealed properly and so will be re-sampled.
- 7) Trout and Croaker was caught at Site 14560 and so will be analyzed for both species separately.

Date: 06.08.2008



* TBD locations not shown on map

Figure 1 Locations of stations for water, sediment and fish

The water sampling activities proceeded without major problems; however a few issues arose as noted below:

- 1) During the course of shipping, it was determined that the 1 μm filter from station 13363 (Bayport channel) was not properly sealed and was thus possibly contaminated with ice in the coolers and water inside the bag. So the sample was rejected and the station will be re-sampled. Corrective actions have been implemented in the form of double bagging the filters so that the problem does not occur again in future.
- 2) A few stations mentioned in the QAPP have been replaced with new stations due to access issues: station 11351 (Buffalo Bayou at Shepherd Dr.), 11129 (Hunting Bayou at North Loop East in Houston), and 11175 (Carpenters bayou immediately Upstream of Loop 8) have been replaced with stations TBD5, TBD6, and TBD7 respectively.
- 3) The micro-pump portion of all pumps had to be replaced due to problems at times with ineffective or inefficient flow. The sample quality should not be affected by the poor pump performance.
- 4) Nearly all of the samples in the QAPP have been collected except for stations near ditches and in Patrick Bayou. The remaining sampling stations along with the Bayport channel station that has to be re-sampled will be sampled in the next quarter.

2.1.2 Sediment Sampling

Sediment samples were collected using a steel Ponar dredge. Prior to collection at each sample site, the dredge, stainless steel spoon/trowel, and stainless steel bucket were rinsed with de-ionized water, then ambient water. Samples were collected and deposited into a stainless

bucket. A minimum of three grab samples along a channel transect were composited using the top 5 centimeters of sediment, mixed thoroughly with a clean stainless steel trowel, and deposited into appropriate labeled, pre-cleaned glass jars as necessary for analysis (PCB, TOC, TPH, Grain size and Solids content). Sampling procedures and handling followed the requirements specified in the project QAPP.

All sediment-sampling locations as specified in the QAPP have been completed. A total of 25 locations have been sampled for sediment in the main channel, San Jacinto River, Upper Galveston Bay, and side bays during the Spring 2008 event (Figure 1). Table 2 includes a summary of the stations sampled for sediments.

2.1.3 Tissue Sampling

Tissue was sampled along with the sediment samples to obtain data on accumulation and/or transport of PCBs. For this sampling component, fish were collected, processed, and analyzed. Species that were sampled include Hardhead catfish (*Arius felis*), Blue catfish (*Ictalurus furcatus*), Speckled trout (*Cynoscion nebulosus*), and Atlantic croaker (*Micropogonias undulates*). All tissue sample collections were conducted using procedures that are consistent with those documented in the *TNRCC Surface Water Quality Monitoring Procedures Manual* and according to the QAPP for this project.

For fish tissue collection, gill nets or fishing lines were used with bait (shrimp or chicken) to catch enough fish (catfish, trout, croaker) to obtain the appropriate mass of muscle tissue. Fish with a total length of 300 mm or greater were the target length for collection. After each station collection, fish were placed into a labeled Ziploc plastic bag, and placed into a cooler with ice. Once all fish samples were collected, the samples were taken to the U of H laboratory, measured,

weighed, and then processed. Collected fish were then filleted with a clean stainless steel knife, packed in clean aluminum foil with the dull side facing the tissue and placed into individual Ziploc bags. Fillets were taken from the left side of the fish and, in most cases; the right side was used as a duplicate sample. All Ziploc bags were labeled, and frozen until shipment was made to the analytical laboratory. The fish tissue samples of a single species collected at a single station were composited into a single sample for analysis.

Fish tissue from 25 locations as mentioned in the QAPP has been collected during Spring 2008 as part of the assessment of current levels and trends (see Table 1 and Figure 1 for locations and descriptions).

Fish tissue sampling proceeded without any major problems, however, the following issues are noteworthy:

- 1) All the sampling locations as specified in the QAPP have been sampled for catfish (designated by F1), while the trout/croaker (designated by F2) were not caught on both nets on the sampling day in some locations. Thus, efforts will be made to catch trout/croaker in the next sampling phase at the stations where trout/croaker has not been caught in the first sampling phase.
- 2) Both trout and croaker (F2 samples) was caught at Site 14560 and so will be analyzed for both species separately. The results are expected to help in bioaccumulation differentiation with species variation.
- 3) Even though station 15936 did not call for fish sampling in the QAPP, fish was caught at the site during sampling. The samples will be analyzed and should supplement the other tissue data that have been gathered.

3. PLANNED ACTIVITIES FOR THE NEXT QUARTER

During the period of June 1, 2008 to August 31, 2008, the project team will be focusing on the following activities:

- 1) The sampling activities for this fiscal year in support of the assessment of current levels and trends of PCBs in the Houston Ship Channel will be completed.
- 2) The quality assurance/quality control (QA/QC) tasks will be carried out including monitoring/coordinating sample deliveries to the laboratories, laboratory compliance with the QAPP, and verification of data packages.
- 3) Initiate additional data collection for the intensive sediment survey pending approval of an amended QAPP that is currently under preparation.