In cooperation with the Galveston Bay Estuary Program

Summary of Findings for TCEQ Contract #: 582-12-22311

U.S. Department of the Interior
U.S. Geological Survey

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Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
mile, nautical (nmi)	1.852	kilometer (km)
yard (yd)	0.9144	meter (m)
	Area	
acre	0.004047	square kilometer (km^2)
square foot (ft^2)	0.09290	square meter (m^2)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
gallon (gal)	3.785	liter (L)
gallon (gal)	0.003785	cubic meter (m^3)
cubic foot (ft^3)	0.02832	cubic meter (m^3)
	Flow rate	
foot per second (ft/s)	0.3048	meter per second (m/s)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
cubic foot per day (ft^3/d)	0.02832	cubic meter per day (m^3/d)
million gallons per day (Mgal/d)	0.04381	cubic meter per second (m^3/s)
	Mass	
pound, avoirdupois (lb)	0.4536	kilogram (kg)
ton per day (ton/d)	0.9072	metric ton per day
ton per day (ton/d)	0.9072	megagram per day (Mg/d)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

°F=(1.8×°C)+32

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

°C=(°F-32)/1.8

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25 °C).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L).

Summary of Findings for TCEQ Contract #: 582-12-22311

Executive Summary

In 2013, the U.S. Geological Survey (USGS), in cooperation with the Galveston Bay Estuary Program (GBEP), began a study to evaluate variability of sediment and nutrient characteristics in the lower reaches of the Trinity and San Jacinto Rivers during a variety of hydrologic conditions. Discharge, sediment concentration and sand/fine break, and nutrient concentration data can be used to gain a better understanding of the hydrologic and water-quality characteristics for the Galveston Bay coastal ecosystem.

In order to maximize efforts on a reduced timescale, in addition to the data collected by sampling, an Acoustic Doppler Velocity Meter (ADVM) was installed at the USGS streamflow gaging station 08067252 Trinity River at Wallisville, TX. This transmitting ADVM will increase collection of velocity and backscatter data and serve as a decision support tool for sample collection. Additionally discharge measurements collected during the time of water sampling would potentially allow for the development of an index velocity rating to the measurement of discharge in the lower reaches of the Trinity River in future studies.

This study aimed to help characterize the sediment and nutrient load transported into Galveston Bay. The flow, sediment, and nutrient data can be used for descriptive purposes as well as serving as input to hydrodynamic and water quality models that aid the understanding of the general Galveston Bay ecosystem.

Introduction

The amount of nutrients and sediment delivered to an estuary affects water aquality and the coastal ecosystem. Adequate amounts of nutrients and sediments are essential to maintain a healthy coastal ecosystem, however, excess nutrients and suspended sediment in the environment can be detrimental to organisms living in and using the coastal waters.

Nutrients are required to sustain life, but excess nutrient loads can upset the nutrient cycle balance resulting in changes in water quality harmful to aquatic organisms (Aldous and others, 2005). Nitrogen and phosphorus compounds occur naturally in coastal streams and rivers but also are commonly applied to land as commercial fertilizers and livestock waste to increase agricultural production (Crain, 2006). Nitrogen is present in water as nitrite and nitrate anions, in cationic form as ammonium (all inorganic nitrogen), and as part of organic solutes (Hem, 1992). In estuarine systems, nitrogen is typically considered to be a limiting nutrient in the growth and survival of organisms (Day and others, 1989; Galveston Bay Estuary Program, 2011).   Phosphorus is usually present as phosphate in natural waters and much of the phosphorus in streams attaches to particulate matter and is unavailable for uptake by plants. Orthophosphate species are the predominant dissolved phosphorus forms in most streams (Terrio, 1995). Nutrients that are not utilized by crops or stored in the soil can runoff to streams in overland flow or infiltrate with groundwater recharge; water quality in estuaries that receive surface-water inflows or groundwater discharge containing excess amounts of nutrients could be degraded (Howarth and others, 2002).

Concentrations of suspended sediment are affected by natural conditions (soil erosion, streambed resuspension) and can be affected by human activities (construction, timber harvesting, certain agricultural practices, and hydraulic alteration). Sediment entering a coastal ecosystem can be beneficial for the growth of plants and the establishment of wetlands. Excessive sediment loads delivered to an estuary can degrade water quality by reducing water clarity and light penetration in the water column. Suspended sediment also plays a major role in the transport and fate of nutrients and other contaminants (Senus and others, 2004). Nutrients can enter coastal waters from sediment where bacteria have mineralized nutrients from organic matter and contaminated material discharged in the surrounding waters may adsorb onto sediment particles (Galveston Bay Estuary Program, 2002, 2011).

In Texas, periods of high flow in streams and rivers flowing into a coastal ecosystem are usually caused by local rainfall or releases from upstream reservoirs made in response to rainfall further upstream in the basin (Galveston Bay Estuary Program, 2002). The increase in rain and resultant flooding can increase sediment erosion and nutrient runoff into coastal rivers and consequently increase sediment and nutrient input into estuaries and bays. Galveston Bay is typical of the estuary systems in Texas in many ways, with extensive nutrient and sediment loading possible during periods of runoff.

Description of Study Area

Galveston Bay is a shallow estuary in southeastern Texas; the Trinity River watershed is largest contributing area to the bay (fig.1). The Trinity River watershed extends from Galveston Bay northwestward to the Dallas/Fort Worth area draining an area of approximately 2120 mi^2 with an annual discharge of approximately 200 billion gallons (Galveston Bay Estuary Program, 2011). The river is regulated by several reservoirs; Lake Livingston in southeast Texas is the largest and separates the upper and lower watersheds of the Trinity River system.

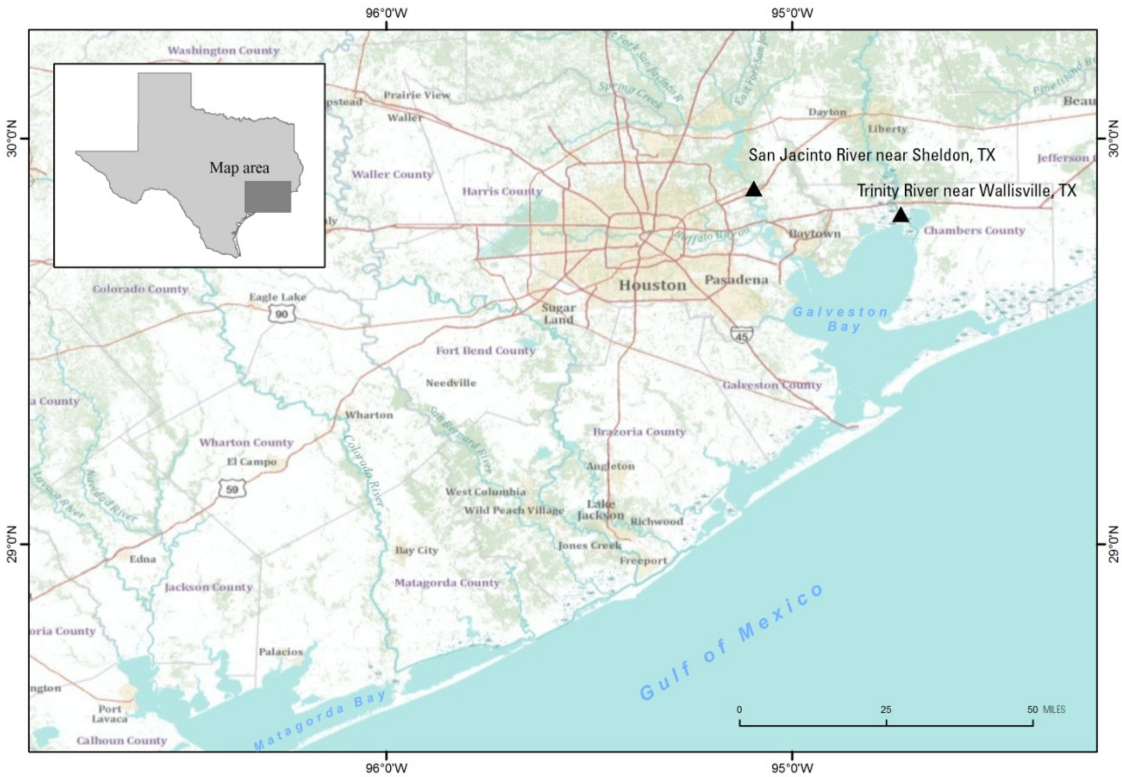

Figure 1. Location of study area and selected data-collection sites.

The Trinity River contributes more than 50% of the average total inflow to Galveston Bay and historical sediment concentrations in the Trinity River can vary appreciably upstream from the entrance into the estuary (Galveston Bay Estuary Program, 2002). A bay head delta that includes one of the largest wetland areas in the Galveston Bay ecosystem is formed where the Trinity River enters the bay (Anderson, 2007).

The San Jacinto River has a drainage area of approximately 3000 sq. mi and is comprised of two forks, simply known as the East and West Forks. The West Fork of the San Jacinto River feeds Lake

Conroe in North Montgomery County, Texas and then flows through urbanized eastern side of the Greater Houston area. The East Fork of the San Jacinto River has its headwaters in Walker County, TX, just north of the Sam Houston National Forest then flows through Liberty and Montgomery Counties before confluencing with the West Fork in Lake Houston.

Astronomical tides in Galveston Bay average approximately 1 ft. but can vary with seasonal wind patterns (Galveston Bay Estuary Program, 2011).

Project Methodology

Site Selection

The USGS streamflow gaging stations, 08067252 Trinity River at Wallisville, TX and streamflow gaging station 08072050 San Jacinto River near Sheldon, TX, were selected as the site for sample collection. Both of the sites are the closest existing USGS stations to the entrance of Galveston Bay on each river inflow and have historic data for comparative purposes.

Streamflow Measurements

Streamflow is the volume of water passing an established reference point in a stream at a given time. The Wallisville gage (at the time of this study) does not have a historical streamflow record or a stage-discharge relation used to compute a continuous record of streamflow from a stage record (Kennedy, 1983) as the other gages upstream. Discharge measurements of the stream at the Wallisville gage were made using an acoustic Doppler current profiler (ADCP) as described in Mueller and Wagner (2009) prior to each sample.

Water-Quality Measurements

Physical water quality properties (water temperature, specific conductance, pH, dissolved oxygen concentration, and turbidity) were measured at the sampling sites using a water quality multi-probe instrument at the time of sampling. Discrete water quality samples were also routinely collected and measured or analyzed for selected water quality properties and dissolved constituents. These selected water quality properties included suspended-sediment concentration, total phosphorous and total nitrogen. Dissolved constituents included nutrients (filtered ammonia, filtered nitrate plus nitrite, filtered nitrite, and filtered orthophosphate). Calculated constituents include filtered nitrate and organic-nitrogen (U.S. Geological Survey, variously dated).

Water quality samples were collected and processed following standard USGS sampling methods as described in the National Field Manual for the Collection of Water Quality Data (U.S. Geological Survey, variously dated). USGS field personnel used isokinetic samplers to manually collect water samples. Isokinetic samplers are designed to accumulate representative, continuous, and depth-integrated water samples within a designated range of stream velocities (Senus and others, 2004). Depth-integrated samples were collected, by using a Teflon bottle and nozzle, within each of five vertical sections to capture variability of constituent concentration within the river cross-section either by multiple verticals when stream velocities were less than about 1.5 feet per second or by utilizing the Equal Discharge Increment approach (EDI) (Edwards and Glysson, 1998) when stream velocities were greater than about 1.5 feet per second. Water quality samples were composited in a polyethylene churn splitter, and sub-samples for whole-water analysis were drawn while churning at a standard rate. The churn splitter was used to allow for subsamples to be drawn while maintaining a uniform distribution of suspended material in the composite sample (Darrell and others, 1999). Water samples for filtered nutrients were passed through a 0.45-micrometer (μm) pore-size filter that was pre-rinsed with deionized water. Whole-water (unfiltered) nutrient samples were preserved using 1 milliliter (mL) of 4.5N sulfuric acid.

Sample Analysis

All nutrient samples were chilled and shipped overnight to the USGS National Water Quality Laboratory (NWQL) in Lakewood, CO. for analysis by using published methods. Methods for nutrient analysis are documented in Fishman (1993), U.S. Environmental Protection Agency (1993; method 365.1), and Patton and Truitt (2000). Suspended-sediment samples were shipped to the USGS Kentucky Water Science Center Sediment Laboratory in Louisville, Kentucky and analyzed for suspended-sediment concentration and particle-size with methods described in Guy (1969) and Mathes and others (1992).

The data for samples gathered during this study at the Trinity River at Wallisville, TX and the San Jacinto River near Sheldon, TX sites are stored in the USGS NWIS database and can be publicly accessed online (U.S. Geological Survey, 2014).

Quality Control

Quality control information is needed to estimate variability that results from sample collection, sample processing, transportation, and laboratory analysis in order to ensure proper interpretation of water quality data (Crain, 2006). Quality control (QC) samples were collected as described in the USGS "National Field Manual for the Collection of Water-Quality Data" (variously dated) and analyzed by the same laboratories and methods as the environmental samples. Split replicates were collected and prepared by dividing a single volume of water into multiple samples to provide a measure of the variability of sample processing and analysis. Replicate samples were compared by computing relative percent differences (RPD); the larger the RPD, the greater the variability in sample-replicate pairs. RPD's for each analyte and replicate sample pair was calculated by the following equation (Crain, 2006):

$$RPD = \left| S1 - S2 \right| / (S1 + S2)/2 \times 100 \qquad (1)$$

where,

S1 = the concentration in the environmental sample, in milligrams per liter; and

S2 = the concentration in the replicate sample, in milligrams per liter

If the RPD of replicate samples was within 20% or less, then the data from the environmental samples were determined to meet the precision objectives of the project. All of the results for quality-control samples are in the USGS National Water Information System (NWISWeb) (U.S. Geological Survey, 2014).

Installation of the Acoustic Doppler Velocity Meter

Amendment 1 of the original Joint Funding Agreement modified this study to aid in the installation of Acoustic Doppler Velocity Meter (ADVM) to be utilized for future studies of the Trinity River. Application of the index velocity method for computing continuous records of discharge has become increasingly common, especially since the introduction of low-cost acoustic Doppler velocity meters (ADVMs) in 1997. Presently, the index velocity method is being used to compute discharge records for approximately 500 gaging stations operated and maintained by the U.S. Geological Survey.

Computing discharge using the index velocity method differs from the traditional stage-discharge method by separating velocity and area into two ratings—the index velocity rating and the stage-area rating. The outputs from each of these ratings, mean channel velocity (*V*) and cross-sectional area (*A*), are then multiplied together to compute a discharge. For the index velocity method, *V* is a function of such parameters as stream velocity, stage, cross-stream velocity, and velocity head, and *A* is a function of stage and cross-section shape. The index velocity method can be used at locations where stage-discharge methods are used, but it is especially appropriate when more than one specific discharge can be measured for a specific stage (Levesque and Oberg, 2012).

Although the primary purpose of this type of ADMV is to measure water velocity, it has been found that additional measures are useful to monitor suspended-sediment transport. As the instrument emits an acoustic pulse into the water and measures the Doppler-shifted frequency of the pulse as it bounces off acoustic reflectors (typically assumed to be primarily sediment particles), the strength of the returned pulse (backscatter) also is measured as it returns to the instrument along the beam path. Backscatter should increase when more particles are present in the water. As a result, the backscatter measurement may be related to suspended-sediment concentration. ADVM technology is low maintenance and sturdy over a range of hydrologic conditions, and measured variables can be modeled to estimate suspended-sediment concentration, load, and duration of elevated levels on a real-time basis (Levesque and Oberg, 2012).

Project Results

Water Quality and Sediment Data

Water Quality and sediment data were collected as described in the Sample Collection, Processing, and Analysis portion of this report. Table 1 shows the field parameters while Table 2 shows the nutrient data, collected for both the Trinity River at Wallisville, TX and the San Jacinto River near Sheldon, TX sites. Due to the modification of the project scope as outlined in Amendment 1 of the Joint

Funding Agreement, data was collected only over a one year period. Data collection efforts focused on the Trinity River due to the plan of the index velocity meter installation. Sampling occurred approximately monthly and during heavy rainfall events on the Trinity River. Only one rainfall event was sampled on the San Jacnto River before focus shifted to the Trinity River.

Table 1: Field parameters collected at both the Trinity River at Wallisville, TX and the San Jacinto River near Sheldon, TX sites.

Date	**Time**	**Discharge, instantaneous, cubic feet per second**	**Dissolved oxygen, water, unfiltered, milligrams per liter**	**pH, water, unfiltered, field, standard units**	**Specific conductance, water, unfiltered, microsiemens per centimeter at 25 degrees Celsius**	**Temperature, water, degrees Celsius**	**Turbidity, water, unfiltered, monochrome near infra-red LED light, 780-900 nm, detection angle 90 +-2.5 degrees**
(dd/mm/yy)	(hhmm)	(cfs)	(mg/l)	(standard units)		(ºC)	(FNU)
			08067252 Trinity River at Wallisville, Tex				
04/25/13[3]	1213	N/A	10.7	8.8	412	20.6	13
05/13/13[1,2]	1216	9390	7.5	7.8	403	21.9	57
05/14/13[1,2]	1200	4670	9.7	8.3	400	22.6	28
06/06/13[1,2]	1215	4280	7.4	8.1	402	28.8	19
08/13/13	1312	798	5.9	8.1	420	32.7	6.6
10/24/13	1240	364	6.4	7.5	368	23.3	19
10/24/13	1241	364	6.4	7.5	368	23.3	19
11/07/13[1,2]	1245	14500	7.6	7.2	409	20.5	83
12/03/13[1,2]	1240	15100	10.2	7.1	400	14.3	36
01/15/14[1,2]	1110	3300	11.9	8.4	376	13.3	110
01/15/14[1,2]	1111	3300	11.9	8.4	376	13.3	110
01/29/14	1145	627	12.5	7.8	397	10.5	8.8
02/21/14[1]	1230	1160	10.8	8.2	368	17.1	8.8
03/11/14	1141	1090	13.5	7.9	336	14.5	13
04/22/14	1222	-14	11.3	8.5	399	22.95	12.3
			8072050 San Jacinto River near Sheldon, Tex				
06/13/13	1220	-1110	9.4	8.7	560	30.8	4.3
08/09/13[3]	1049	N/A	7	8.4	9220	31.7	2.9
09/27/13	1215	354	9.5	8.6	2120	28.7	7.4
09/27/13	1216	354	9.5	8.6	2120	28.7	7.4
10/29/13[2]	1145	1690	9.3	8.7	363	22.6	12

[1] Signifies that gates at the Salt Water Barrier were open
[2] Signifies rainfall events
[3] Signifies equipment failures leading to no discharge measurement.

Table 2: Nutrient data collected at both the Trinity River at Wallisville, TX and the San Jacinto River near Sheldon, TX sites.

Date (dd/mm/yy)	**Time** (hhmm)	**Ammonia, water, filtered, as nitrogen** (mg/l)	**Nitrate plus nitrite, water, as nitrogen** (mg/l)	**Nitrite, water, filtered, as nitrogen** (mg/l)	**Orthophosphate, water, filtered, as phosphorus** (mg/l)	**Phosphorus, water, unfiltered, milligrams per liter as phosphorus** (mg/l)	**Total nitrogen (nitrate + nitrite + ammonia + organic-N), water, unfiltered, analytically determined** (mg/l)
08067252 Trinity River at Wallisville, Tex							
04/25/13[3]	1213	<0.01	<0.04	<0.001	<0.004	0.085	0.81
05/13/13[1,2]	1216	0.018	0.287	0.026	0.009	0.213	1.47
05/14/13[1,2]	1200	<0.01	0.107	0.015	<0.004	0.129	1.08
06/06/13[1,2]	1215	0.014	<0.04	<0.001	0.015	0.117	0.81
08/13/13	1312	0.016	<0.04	0.003	0.039	0.084	0.67
10/24/13	1240	0.023	0.061	0.005	0.039	0.115	0.88
10/24/13	1241	0.025	0.062	0.007	0.038	0.115	1.16
11/07/13[1,2]	1245	0.085	0.178	0.041	0.018	0.248	1.19
12/03/13[1,2]	1240	0.04	0.381	0.023	0.02	0.123	1.17
01/15/14[1,2]	1110	<0.01	0.435	0.003	0.01	0.101	1.2
01/15/14[1,2]	1111	<0.01	0.431	0.004	0.01	0.106	1.16
01/29/14	1145	0.015	0.397	0.004	<0.004	0.082	1.11
02/21/14[1]	1230	<0.01	0.281	0.003	0.005	0.101	1.23
03/11/14	1141	<0.01	0.112	0.003	0.013	0.116	1.14
04/22/14	1222	<0.01	0.508	0.013	<0.004	0.059	1.17
8072050 San Jacinto River near Sheldon, Tex							
06/13/13	1220	0.025	<0.04	0.001	0.2	0.271	0.85
08/09/13[3]	1049	0.1	<0.04	0.017	0.386	0.564	0.92
09/27/13	1215	0.123	0.073	0.041	0.339	0.445	1.12
09/27/13	1216	0.125	0.07	0.041	0.343	0.442	1.1
10/29/13[2]	1145	<0.01	<0.04	<0.001	0.263	0.38	1.09

[1] Signifies that gates at the Salt Water Barrier were open
[2] Signifies rainfall events
[3] Signifies equipment failures leading to no discharge measurement.

Table 3 shows the sand/fine break and suspended sediment concentration data collected for both the Trinity River ant Wallisville, TX and the San Jacinto River near Sheldon, TX sites.

Table 3: Sand fine/break and suspended sediment data for both the Trinity River at Wallisville, TX and the San Jacinto River near Sheldon, TX sites.

Date	Time	Suspended sediment <0.0625mm	Suspended sediment concentration
(dd/mm/yy)	(hhmm)	(%)	(mg/l)
08067252 Trinity River at Wallisville, Tex			
04/25/13[3]	1213	95	30
05/13/13[1,2]	1216	97	205
05/14/13[1,2]	1200	91	67
06/06/13[1,2]	1215	98	48
08/13/13	1312	95	12
10/24/13	1240	96	19
10/24/13	1241	95	20
11/07/13[1,2]	1245	82	406
12/03/13[1,2]	1240	61	159
01/15/14[1,2]	1110	86	38
01/15/14[1,2]	1111	86	38
01/29/14	1145	95	18
02/21/14[1]	1230	100	25
8072050 San Jacinto River near Sheldon, Tex			
06/13/13	1220	89	9
08/09/13[3]	1049	100	5
09/27/13	1215	85	6
09/27/13	1216	91	6
10/29/13[2]	1145	70	16

[1] Signifies that gates at the Salt Water Barrier were open
[2] Signifies rainfall events
[3] Signifies equipment failures leading to no discharge measurement.

Bed material data was only collected when a moving bed condition was indicated by the Acoustic Doppler Current Profiler. The only moving bed condition indicated during the sampling period was at the Trinity River at Wallisville, TX site and is shown in Table 4.

Table 4: Bed material data for the Trinity River at Wallisville, TX site

	Sample Date and Time (dd/mm/yyyy hhmm)	
	5/13/2013 1216[1]	5/14/2013 1200[1]
Bed sediment, fall diameter (deionized water), percent smaller than 0.002 millimeters	11	N/A
Bed sediment, fall diameter (deionized water), percent smaller than 0.004 millimeters	12	N/A
Bed sediment, fall diameter (deionized water), percent smaller than 0.008 millimeters	13	N/A
Bed sediment, fall diameter (deionized water), percent smaller than 0.016 millimeters	14	N/A
Bed sediment, fall diameter (deionized water), percent smaller than 0.031 millimeters	17	N/A
Bed sediment, sieve diameter, percent smaller than 0.0625 millimeters	22	5
Bed sediment, sieve diameter, percent smaller than 0.125 millimeters	32	7
Bed sediment, sieve diameter, percent smaller than 0.25 millimeters	94	43
Bed sediment, sieve diameter, percent smaller than 0.5 millimeters	100	90
Bed sediment, sieve diameter, percent smaller than 1 millimeter	N/A	95
Bed sediment, sieve diameter, percent smaller than 2 millimeters	N/A	97
Bed sediment, sieve diameter, percent smaller than 4 millimeters	N/A	98
Bed sediment, sieve diameter, percent smaller than 8 millimeters	N/A	100

[1] Signifies that gates at the Salt Water Barrier were open

Quality control information is needed to estimate variability that results from sample collection, sample processing, transportation, and laboratory analysis in order to ensure proper interpretation of water quality data (Crain, 2006). Replicate samples were compared by computing relative percent differences (RPD); the larger the RPD, the greater the variability in sample-replicate pairs. The average RPD's for the nutrient and suspended sediment data for both the Trinity River at Wallisville, TX and the San Jacinto River near Sheldon, TX sites are shown in Table 5.

Table 5. Average RPD for both the Trinity River at Wallisville, TX and the San Jacinto River near Sheldon, TX sites.

Date	Time	RDP for Ammonia, water, filtered, as nitrogen	RPD for Nitrate plus nitrite, water, as nitrogen	RPD for Nitrite, water, filtered, as nitrogen	RPD for Orthophosphate, water, filtered, as phosphorus	RPD for Phosphorus, water, unfiltered, milligrams per liter as phosphorus	RPD for Total nitrogen (nitrate + nitrite + ammonia + organic-N), water, unfiltered, analytically determined	RPD for Suspended Sediment Data
	(hhmm)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
08067252 Trinity River at Wallisville, Tex								
10/24/2013	1240	2.1	0.4	8.3	0.6	0.0	6.9	0.8
1/15/2014	1111	0.0	0.2	7.1	0.0	1.2	0.8	N/A
8072050 San Jacinto River near Sheldon, Tex								
9/27/2013	1215	0.4	1.0	0.0	0.3	0.2	0.5	0.9

Installation of the Acoustic Doppler Velocity Meter

In order to maximize efforts on a reduced timescale, in addition to the data collected by sampling, an Acoustic Doppler Velocity Meter (ADVM) was installed at the USGS streamflow gaging station 08067252 Trinity River at Wallisville, TX. This ADVM was installed in accordance with USGS standards and practices and with additional assistance and in kind services from the Texas Water

Development Board and the United Sates Army Corps of Engineers. The data from this ADVM is available on NWIS web and can be accessed at *http://waterdata.usgs.gov/nwis*. This gage should prove to be a useful tool in future assessment of discharge and sediment/nutrient loading into the Galveston Bay system.

The installed ADVM at the streamflow gaging station 08067252 Trinity River at Wallisville, TX consists of a SonTek Argonaut SL1500, bolted to a Cupronickel 2” diameter pipe that is pinned in placeto a steel bracket that is welded onto the stream bulkhead at the gage location, as shown in Figure 2.

Figure 2. Sontek Argonaut SL1500 and associated bracket at USGS streamflow gaging station 08067252 Trinity River at Wallisville, TX.

Power is provided by a marine battery charged by a 30 watt solar panel installed above the gage house. The data is recorded in 15 minute intervals by a Sutron SatLink2-V2 Data Collection Platform (DCP), and then transmitted via a Helical antenna to the GOES satellite, to a downlink at the USGS office for display on the web and storage in the USGS NWIS database.

The gage enclosure housing the DCP and Battery were mounted on a steel 4” diameter pipe at an elevation above historical flood elevations, which was concreted 3’ into the ground. The completed installation is shown as Figure 3.

Figure 3. USGS streamflow gaging station 08067252 Trinity River at Wallisville, TX.

Project Conclusions and Lessons Learned

The project was hampered by a lack of high flow events on the San Jacinto River and only a few moderate events on the Trinity. Higher flow events on both systems would have provided a more representative data set of hydrologic conditions previously observed on both systems. However, the samples collected in this study are of excellent quality and should be useful for future research and a better understanding of these freshwater inflow sources. Additional samples over a variety of hydrologic conditions and discharge scenarios are needed to better asses conditions on these rivers.

Due to the reduction in time allowed for sample collection and the uncertainty of project extension, the scope of the project was changed to allow for the installation of the Acoustic Doppler Velocity Meter (ADVM) at the USGS streamflow gaging station 08067252 Trinity River at Wallisville, TX. Previous research by USGS on the Trinity River demonstrated that discharge data from upstream gages, commonly used to estimate freshwater inflows into Galveston Bay, may not accurately represent actual discharge into Trinity Bay. The influence of tides near the bay entrance and the dampening of river discharge due to overland runoff during high flow events necessitate more accurate measurements and computations of discharge in the lowest reach of the Trinity River. Additionally, calibration of acoustic Doppler velocity meter backscatter data holds promise for estimating sediment and nutrient concentrations carried by the river. This installation of the index velocity gage should prove to be a useful tool in future assessment of discharge and sediment/nutrient loading into the Galveston Bay system.

Future research planned with the Basin and Bay Area Stakeholder Committee through the Texas Water Development Board will provide a continuous record of Trinity River discharge and backscatter data from this gage. The data collected during this project with GBEP is critical and will be included in any future analysis of the Trinity and San Jacinto Rivers by the USGS. This information will be useful for inclusion in hydrodynamic and water quality models and will provide better understanding of the volume of freshwater inflow entering the Galveston Bay ecosystem. In-kind services supporting this project will be provided by the USGS and the U.S. Army Corp of Engineers.

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