PORTCORPUSCHRISTI

Project Turnpike
Water and Sediment Sampling and Analysis Report

Wood Project No. 6703180051

For Submittal to:

Port of Corpus Christi Authority
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1.0 Background and Approach

The Port of Corpus Christi Authority of Nueces County (PCCA) is planning to develop Project Turnpike, a crude oil export terminal at Harbor Island north of Port Aransas, Texas (**Figure 1**). The project requires two marine berths with a turning basin large enough to move Very Large Crude Carriers (VLCCs) into and out of the berths.

To develop baseline data for United States Army Corps of Engineers (USACE) permitting of Project Turnpike under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, Wood Environment & Infrastructure Solutions (Wood) proposed to collect sediment, benthic invertebrates, plankton samples, and measure water current velocity and quality parameters. These samples and measurements were proposed for the berth areas and turning basin.

2.0 Sample Collection

2.1 Overview

Sediment samples were collected for submerged aquatic vegetation, grain size, total organic carbon (TOC), and benthic macroinvertebrates to characterize local substrate. Water measurements and sampling consisted of current water velocity and water quality data. Plankton samples were collected. The plankton sample results identified the abundances and diversity of adult and larval marine species found within the water column. Oyster and seagrass surveys were also conducted to determine presence or absence of these habitats, and the extent of them if present. Photographic documentation of the field activities are provided in **Attachment 1**.

2.2 Sample Sites/Locations

Wood identified 15 sample sites for the project (**Figure 2** and **Table 1**). These 15 sample points include five locations within the turning basin, four within the planned turning basin near Berth 1A, and two locations within each of the three prospective berth locations.

Global Positioning System (GPS) coordinates were used to position the watercraft over the sample locations. Depth to sediment, water levels relative to the mean lower low water (MLLW), and other pertinent information was recorded on datasheets (**Attachment 2**) and by Naismith Marine (Naismith) at each sample location. The date and time of sample collection was recorded so that measurements could be correlated to water level measurements at the Port Aransas, Texas tide gauge (Station ID 8775237) and current measurements at the Port Aransas, Channel View current gauge (Station ID cc0301). Both stations are operated by the National Oceanic and Atmospheric Administration.

2.3 Sediment Sampling

Wood collected 14 sediment substrate samples using a Petite Ponar dredge (**Figure 3**). The dredge was brought onboard and emptied into a stainless-steel bowl. Multiple drops were necessary in some locations to collect sufficient volume for filling the sample containers. After sufficient sediment was retrieved it was inspected and described as to sediment type and color. After describing the material, it was thoroughly mixed before placing into clean sample containers provided by the laboratory. The sample containers were labeled and then placed into a cooler

with ice. Samples were accumulated over the three days of sampling and maintained on ice. Upon completing the sediment sampling, the samples were repackaged and sent to the analytical laboratory under proper chain of custody documentation.

2.4 Benthic Macroinvertebrate Sampling

Benthic macroinvertebrate samples were collected with a Petite Ponar dredge at 15 sampling locations (**Figure 3**). The dredge was brought onboard and emptied into a plastic tub. The insides of the dredge were thoroughly rinsed to ensure all material was removed. The sediment in the plastic tub was emptied into a U.S. Standard No. 35 sieve with a 500 µm mesh. The material was thoroughly sieved to remove particles and organisms smaller than the designated mesh size. The remaining material on the sieve was transferred to a sample container and a magnesium sulfate solution was added to relax the organisms. The sieve was carefully inspected to ensure all organisms had been removed and placed into the sample container. Any organisms stuck in the mesh were removed with forceps and placed in the sample container. An internal sample label with the sample identification and collection date was added to each sample container. The sieve was gently scrubbed in between each sampling location to prevent contamination from one site to the next. Upon completion of fieldwork each day, samples were transferred to approximately a 10% formalin solution stained with Rose Bengal to fix the organisms. Samples were shipped to the Wood taxonomy laboratory in Newberry, Florida for processing by qualified taxonomists.

2.5 Water Quality Sampling

Wood collected water quality measurements at 15 sample sites presented in **Figure 4**. Wood measured water quality parameters of salinity, dissolved oxygen (DO), and temperature using a field calibrated meter (YSI 6920). Data was collected at 5-foot intervals from the surface to the bottom of the channel.

2.6 Seagrass and Oyster Surveys

Prior to mobilization, Wood performed a desktop survey of the area for the presence of known seagrass and oyster beds. Based on these results, neither seagrass or oysters were expected to occur in the designated sampling area. To confirm this, Wood personnel noted the presence or absence of seagrass and oysters during the sediment and benthic invertebrate sampling, and performed two additional surveys in areas where seagrass and/or oysters were suspected to occur. For the latter two surveys, the Petite Ponar dredge was used to collect approximately 30 samples in a grid pattern to look for the presence of seagrass or oyster beds (**Figure 5**). Additionally, shallow areas within the project boundary were visually evaluated to the extent possible.

2.7 Plankton Sampling

Plankton samples were collected at two different locations with a 333 µm, 0.5 m diameter conical mesh net equipped with a flow meter and removable collection container on the cod end (**Figure 6**). The net was towed from the boat in a manner that minimizes disturbance from the bow wake. The deployment consisted of a diagonal tow through the water column from approximately the mid-water column to the surface, to encompass varying depths. The net was deployed for approximately 10 minutes or the time necessary for a minimum of 50 cubic meters (m^3) of water to pass through the net, as indicated by the flow meter. Upon retrieval, the net was rinsed and back-rinsed through the mesh into the removable cup. The contents were transferred to labeled

sample containers and preserved with 4% formalin. An internal sample label with the sample identification and collection date was added to each sample container. Samples were shipped to Wood's taxonomy laboratory in Newberry, Florida for processing.

2.8 Water Velocity

Wood collected water velocity measurements at 24 sample sites presented in **Figure 7**. After setting upon the sample locations Wood measured the current velocity during a flood and ebb tide using a Valeport 106 Water Velocity Meter. Documentation included the tidal chart for the day of sampling and the time, location, and depth of each measurement to MLLW using the Port Aransas, Channel View current gauge (Station ID cc0301) and Port Aransas, Texas tide gauge (Station ID 8775237). Data were collected at 5-foot intervals from the surface to the bottom of the channel.

2.9 Deviations

Wood had deviations in sampling locations due to lack of substrate to sample, sediment depth greater than project dredging depth, weather, and safety issues. Sediment samples were collected at 14 locations instead of 15. This was due to sample L-6 lacking sediment which could be collected in the Petite Ponar dredge. Only shell hash was retrieved with the 14 drops of the dredge. Sample locations L-5 and L-6 were moved from the south side of the turning basin to the north side of the turning basin because the depth to sediment at the proposed locations was deeper than the project dredging depth. Visibility issues were cited when collecting water velocity readings during the night.

3.0 Analyses

3.1 Physical and Chemical Analyses

The sediment samples were shipped to ALS Laboratories, Inc. (ALS) in Houston, Texas. ALS analyzed the samples for TOC using United States Environmental Protection Agency Method 1995. ALS subcontracted with Tolunay-Wong Engineers, Inc. (TWE) for the grain size analyses which was performed using American Society for Testing and Materials Method D422 and hydrometer analyses. ALS is an accredited laboratory recognized by the National Environmental Laboratory Accreditation Program.

3.2 Laboratory Quality Control

ALS reported that the recovery of the matrix spike (MS) and/or matrix spike duplicate (MSD) for sample L-2 MS and L-2 MSD were outside of established control limits. However, the laboratory control sample was within control limits and the recovery of the MS/MSD was due to sample matrix interference. Otherwise, ALS and TWE reported no quality control issues and the analytical results were accepted.

3.3 Chain of Custody

As previously described, samples were shipped to the analytical laboratories under proper chain of custody. Copies of the chains of custody are included in the laboratory reports (**Attachment 3**).

3.4 Laboratory Deviations

The laboratories reported no deviations to their standard operating procedures or analytical methods.

3.5 Benthic Macroinvertebrate Sample Processing

Benthic macroinvertebrate samples were processed in the laboratory following guidance provided by the Texas Commission on Environmental Quality (TCEQ) in "*Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data*". Upon receipt of the benthic invertebrate samples by the Wood taxonomy laboratory, the samples were cross-checked against the chain of custody and logged in. Prior to sorting, the formalin was poured off through a sieve, captured and adequately disposed of. The sample was rinsed in freshwater and then preserved in 70% isopropyl alcohol. Samples were sorted in their entirety by placing small aliquots in petri dishes and sorted under a dissecting microscope by removing organisms from debris and placing them into vials filled with 70% isopropyl alcohol. Internal labels were added to the vials with the sample identification and collection date. Ten percent of samples were checked by a second qualified individual to ensure that 90% sorting efficiency has been achieved. If sorting efficiency falls below 90% for an individual, the remaining samples that this individual processed were resorted.

Benthic macroinvertebrates from each sample were enumerated and identified by qualified taxonomists to the lowest practical taxonomic level, which was usually species level. This was not always possible for immature or damaged organisms, and was noted on the laboratory bench sheets. Organisms were identified using various dissecting and compound microscopes along with appropriate taxonomic keys and references. Wood's extensive voucher collection was also used as reference. Five percent of samples were identified and enumerated by a second taxonomist for quality control. A photograph log can be found in **Attachment 4**.

Data were entered into a Structured Query Language (SQL) relational database and exported to Excel for reporting requirements. A phylogenetic taxonomic list with raw abundances and densities in terms of number of benthic macroinvertebrates per square meter were provided for each sample. PRIMER v7 was utilized to calculate various richness and diversity indices. Nonparametric multivariate statistical analyses were performed to determine significant spatial trends in the benthic community and correlations with the environmental variables.

3.6 Plankton Sample Processing

In the laboratory, samples were processed according to the methods described in APHA 10200 (1995). Upon receipt of the plankton samples by the Wood taxonomy laboratory, the samples were cross-checked against the chain of custody and were logged in. Prior to sorting, the formalin was poured off through a sieve, captured and adequately disposed of. The sample was rinsed in freshwater and then preserved in 70% isopropyl alcohol. The samples were viewed under a stereoscopic microscope and ichthyoplankton were removed from the entire sample and placed into a vial of 70% isopropyl alcohol and labeled with the sample ID and date of collection.

Subsampling with a Folsom plankton splitter was employed following removal of ichthyoplankton due to the large number (>500) of organisms present in the zooplankton samples. On a level surface, each sample was placed into the splitter and divided into sub-splits. The splitter was rinsed into the subsamples to remove any organisms stuck on the device. This splitting process was

conducted five times in order to achieve a target number of approximately 200-500 individuals present in the analyzed subsamples.

Ichthyoplankton and zooplankton organisms from each sample were enumerated and identified by qualified taxonomists to the lowest practical taxonomic level, which is usually species. This is not always possible for immature or damaged organisms, so this was noted on the laboratory bench sheets. Zooplankton were identified to lowest possible taxonomic level by using a stereoscopic microscope capable of a magnification of 10-63x and/or a differential interference contrast compound microscope equipped with a magnification range of 40-1000x. Enumerations were conducted with a multiple tally counter. Ichthyoplankton were identified and enumerated under a stereoscopic microscope at magnification of 10-50x. Appropriate taxonomic keys, references, and Wood's extensive voucher collection were also used to aid identification.

Data were entered into a SQL relational database and exported to Excel for reporting requirements. A phylogenetic taxonomic list with raw abundances and densities in terms of number of organisms per cubic meter of water was provided for each sample. PRIMER v7 was utilized to calculate various richness and diversity indices. Nonparametric multivariate statistical analyses were also performed to determine significant spatial trends in the plankton community and correlations with the environmental variables.

4.0 Analytical Results

4.1 Sediment Samples

Results for the sediment samples are presented in **Table 2**. The sediment sampled was visually characterized as predominantly fine sand with silt and clay present. The color of the sediment was predominantly gray with some samples containing a black clay and had no odor. Shell hash was also observed in several samples.

The grain size analyses are presented in **Table 3**. Coarse gravel ranged from 0.0% to 1.2%, fine gravel from 0.0% to 59.6%, coarse sand from 0.0% to 8.9%, medium sand from 0.1% to 6.8%, fine sand from 32.1% to 95.6%, silt from 2.0% to 53.1%, and clay from 1.5% to 16.3%. Sediment samples from L-4, L-12, and L-13 were the only samples to contain gravel which was identified in the field as shell or shell hash. L-13 contained the highest amount of gravel (shell hash) with a composition of 59%.

TOC concentrations (**Table 3**) ranged from non-detect in samples L-5, L-7, L-8, L-9, and L-15 to 0.515 weight%-dry in sample L-11. ALS reported the sample detection limit and method quantitation limit as 0.0600 weight%-dry. Sample locations with TOC detections were located closer to land or near tributaries. TOC was not detected in samples collected in the proposed turning basin. Samples collected from L-11 and L-13 located in the Tributary Channel to Aransas Pass had the highest TOC concentrations.

4.2 Benthic Macroinvertebrate Samples

A total of 167 different taxa and 1,523 individuals were identified from the 15 benthic macroinvertebrate samples (**Appendix 1**). The raw abundances were converted to densities by dividing by the area of the Petite Ponar grab. The densities ranged from 258 to 31,172 individuals/m^2 (**Table 4**). Various diversity indices were calculated with the DIVERSE function in

PRIMER v7 for each of the samples and are displayed in **Table 4**. Samples from L-5, L-7, L-8 and L-9 had the lowest abundance, number of taxa, Margalef's richness, and Shannon's diversity indices. Alternatively, the sample from L-2 exhibited the highest density due to numerous juvenile bivalve shells belonging to the Family Tellinidae and polychaete worms belonging to the genus *Mediomastus*. Samples from L-6 and L-12 had the highest Margalef's richness scores, while higher Shannon's diversity were observed from Samples L-4, L-12, and L-15.

Several nonparametric multivariate statistical analyses were performed in PRIMER v7 to examine spatial trends in the benthic macroinvertebrate community. Bray-Curtis similarities were calculated between samples to produce a resemblance matrix (Bray and Curtis, 1957; Clarke *et al.*, 2006). The CLUSTER analysis, which uses hierarchical agglomerative clustering with group average sorting, was applied to the Bray-Curtis resemblance matrix. Similarity profile permutation tests (SIMPROF) used 1000 permutations to identify significant sample groups within the dendrogram produced by the CLUSTER analysis. The CLUSTER analysis results depicted five groups of samples that were significantly different than each other (**Figure 8**). Solid black lines indicated significant differences between samples or sample groups ($p<0.05$), while red dotted lines indicated no significant differences ($p>0.05$). The sample group consisting of L-5, L-7, L-8, and L-9 was significantly different than the rest of the samples and consisted of samples that were characterized by low abundances, richness, and diversity. Samples from L-2 and L-6 were significantly different from all other samples due to higher abundances within these samples that were at least double that in the remaining samples. Samples from L-4, L-12, L-13, L-14, and L-15 comprised the fourth group and exhibited fairly high richness and diversity. Samples from L-1, L-3, L-10, and L-11 comprised the last group which was characterized by moderate richness and diversity (**Table 4**).

Additionally, Bray-Curtis similarities were ordinated with non-metric Multidimensional Scaling (nMDS). The 5% significance level was used as a factor in the nMDS to further illustrate the significant relationships between the sample groups in 2-D space (**Figure 9**). The closer the sample points were to each other the more similar their benthic community structure. Similar sample grouping was observed in the nMDS as compared to the CLUSTER dendrogram. Analysis of Similarity (ANOSIM) confirmed statistically significant differences between the five sample groups represented in the CLUSTER dendrogram and the nMDS plot ($p<0.05$).

The BEST analysis with the BIOENV option was performed in order to ascertain which combination of the physicochemical parameters (grain size, %TOC, depth, salinity, DO, and temperature) were best correlated with the observed benthic community structure. No significant correlations were observed with any of the physicochemical parameters or any combination of these parameters ($p>0.05$).

4.3 Water Quality

Water quality measurements varied throughout the sample locations (**Table 5**). In general, DO in the ship channel and tributary increased with depth. In deeper waters (Turning Basin), DO varied with depth but tended to decrease with depth. Salinity was variable between each sampling point and the measurements generally increased slightly with depth. Sampling points with the highest salinity were points L-1, L-7, and L-8. These readings ranged from 22.48 parts per thousand (ppt) to 25.07 ppt. The sampling points with the lowest salinity were recorded at L-9 and L-10. These readings ranged from 15.32 ppt to 15.52 ppt. In general, water temperature in the Turning Basin

decreased as depth increased. In the shallower locations (the tributary and ship channel), temperature generally decreased as depth increased. However, sample points L-2, L-13, and L-14 all showed increasing temperature as depth increased.

4.4 Seagrass and Oyster

Shallow areas of the sampling area were visually inspected during the field sampling effort for the presence of seagrass or oyster beds. No seagrass or oyster beds were observed in these shallow areas from the boat. While collecting the sediment and benthic macroinvertebrate samples at Sites L-2 and L-14, one live strand of *Halodule wrightii* was retrieved at each station (**Table 6**). No live oysters were retrieved in any of the sediment or benthic macroinvertebrate grab samples collected in the sampling area.

Based on the slight presence of *H. wrightii* at these two sampling locations, transects were setup to ground truth the presence of seagrass beds, and if present, the extent of these beds. One transect was located in between Sites L-1 and L-2, while the other transect was located in a shallow area with decent water clarity near Site L-12 and across the Tributary Channel from Site L-14. A seagrass transect was not conducted near Site L-14 because of its close proximity to a seawall, water with poor visibility and heavy boat traffic where seagrass would be unlikely to occur (**Figure 5**). Fifteen Petite Ponar grab samples were collected along each of the two transects. Seagrass was not found in any of the grab samples from the first seagrass transect (SG-1), and only two strands of *H. wrightii* were retrieved in one of the grab samples from the second seagrass transect (SG-2) (**Table 6**). Based on these observations, seagrass and oyster beds are unlikely to occur in the sampling area. The slight presence of one to two live strands of seagrass collected in a few of the grab samples was incidental. These strands were most likely not rooted in the sampling area and drifted in from a seagrass bed near the vicinity of the proposed project area.

4.5 Plankton Samples

A total of 37 different taxa and 1,539 individuals were identified from the two ichthyoplankton samples and zooplankton subsamples (**Appendix 2**). Zooplankton samples were split five times in order to reach the target number of 200-500 organisms in the subsample selected for taxonomic identification. Therefore, raw abundances from the identified zooplankton subsamples were multiplied by 32 in order to estimate the total number of each taxon in the entire sample. These estimates were combined with the ichthyoplankton abundances to represent the entire plankton sample. The abundances in the entire plankton sample were then converted to densities by dividing by the volume of water that passed through the plankton net during sample collection. Total plankton densities were 228/m^3 and 187/m^3 for P-1 and P-2 respectively. Both samples had fairly high taxa richness; however, the plankton samples were dominated by calanoid copepods belonging to the Family Pontellidae. This dominance led to lower diversity scores (see **Table 4**).

Because only two plankton samples were collected, the CLUSTER analysis with the SIMPROF option was the only nonparametric multivariate analysis performed in PRIMER v7. Four samples are needed for nMDS and three samples are needed for the BEST analysis. The CLUSTER analysis determined the two plankton samples were 75% similar and not significantly different than each other (**Figure 10**).

4.6 Water Velocity

Velocity measurements were variable throughout the site by location and depth (**Table 7**). As expected, velocities were generally higher in open water and decreased near shore and near the channel bottom where friction losses would be expected. Flows typically ranged from 0.1 to 0.5 m/s, or 0.3 to 1.5 ft/s.

5.0 Conclusions

Sediment in the study area is predominantly fine sand with abundant silt and clay. Shell hash was present in about a third of the samples.

Significant spatial variability in the benthic macroinvertebrate community structure was observed in the sampling area. Samples L-2 and L-6 were significantly different from all other samples, and exhibited higher abundances and diversity. Sample L-2 consisted of dead seagrass blades which had several different types of epiphytic organisms growing on them, thereby provided more habitat structure and food for benthic macroinvertebrates. Sample L-6 contained a moderate amount of shell hash which provided habitat for several different types of organisms such as: epiphytic organisms attached to the shell pieces; polydorid polychaete worms that bore into the shell pieces; and corophiid amphipods that form mud tubes within the crevices of the shell hash (Hartman, 1941; LeCroy, 2004). Moderate to high abundances and diversity were observed in samples taken from shallow water along the south and east sides of Harbor Island and the east side of the Tributary Channel. The samples with the lowest abundances and diversity were all similar to each other and all located in the proposed turning basin which is also the confluence of the three main shipping channels. Variable currents within this area and potential disturbance from ship traffic may be contributing to unfavorable conditions for benthic macroinvertebrates.

Water quality parameters varied throughout the study area. Generally, DO increased with depth in the channel area and tributaries but decreased with depth in the turning basin. Salinity also generally increased slightly with depth. Temperature generally decreased with depth.

Only several strands of seagrass were observed in the study area and no live oysters were observed. Sampling in areas where seagrass and oysters might be expected indicated no presence. Seagrass and oyster beds are unlikely to occur in the project area.

Plankton community structure did not exhibit any spatial variability as the two tows were 75% similar to each other. Both samples were dominated by calanoid copepods belonging to the Family Pontellidae which drove down the diversity scores. Alternatively, taxa richness was fairly high in both tows. The plankton community at Harbor Island was comprised of both holoplanktonic (organisms that are planktonic their entire life) and meroplanktonic (organisms that are planktonic only part of their life) organisms. Detrimental effects from dredging and construction of the berths around Harbor Island are unanticipated for the holoplankton community as sufficient current and tidal exchange was observed in this area which would replenish any losses to this community. A slight reduction in the meroplanktonic larvae may occur due to losses in the benthic community as discussed below, but would recover upon re-establishment of a reproductively-viable benthic community.

Velocity measurements were variable throughout the site and were generally higher in open water and decreased near shore and near the channel bottom.

Dredging and construction of the berths around Harbor Island will have an immediate impact on the benthic community due to the physical disturbance of the sediments. The recovery time of benthic communities following dredging activities is highly variable and dependent on a multitude of factors. Opportunistic, mobile, and stress-tolerant species may occur in high densities following disturbance, and areas with these types of species have been shown to be more resistant to dredging effects as compared to areas with sessile, long-living and sensitive species (Bonsdorff, 1980; Bemvenuiti *et al.*, 2005). Additionally, benthic communities have been shown to recover faster in areas with sufficient water exchange and steeper slopes as opposed to flat-bottom, sheltered areas (Van Dolah *et al.*, 1984; Kotta *et al.*, 2009; Szymelfenig *et al.*, 2006). Maintenance dredging and frequent physical disturbances have also been shown to slow benthic community recovery. Given the current velocities and tidal exchange observed during the field sampling, it is hypothesized that the benthic community will have a reasonably swift recovery assuming no recurrent physical disturbance. However, the increased ship traffic to this area will likely cause some recurrent physical disturbance and may slow the recovery process. Post-dredging monitoring consisting of several sampling events throughout the first year following completion of construction is recommended to assess the benthic community recovery process.

6.0 References

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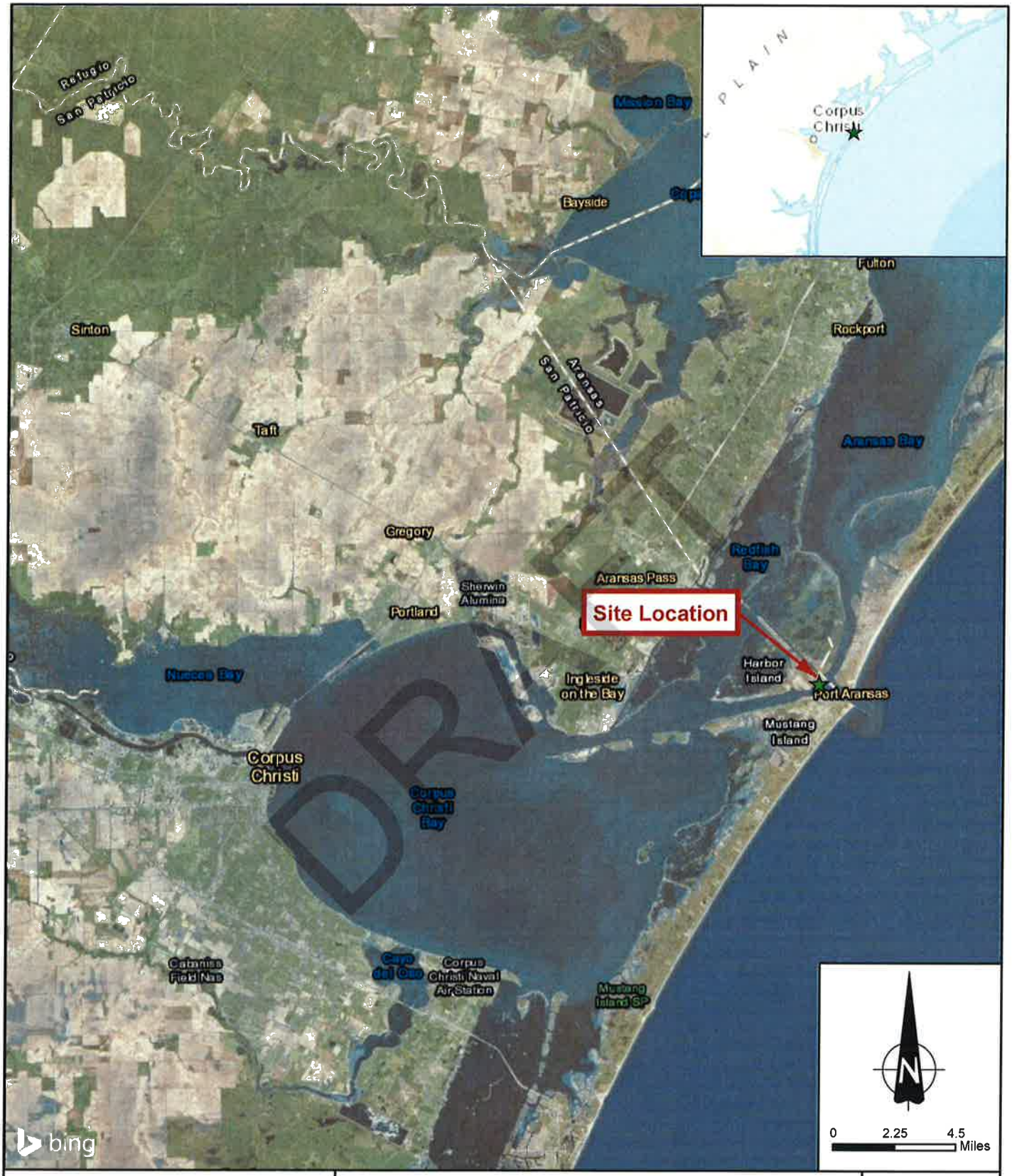
FIGURES



PCCA Harbor Island
Permit Application
Site Location

★ Site Location

wood.

DATE	JUNE 2019
SCALE	1 " = 5 miles
PROJECT NO.	6703180051
FIGURE	1

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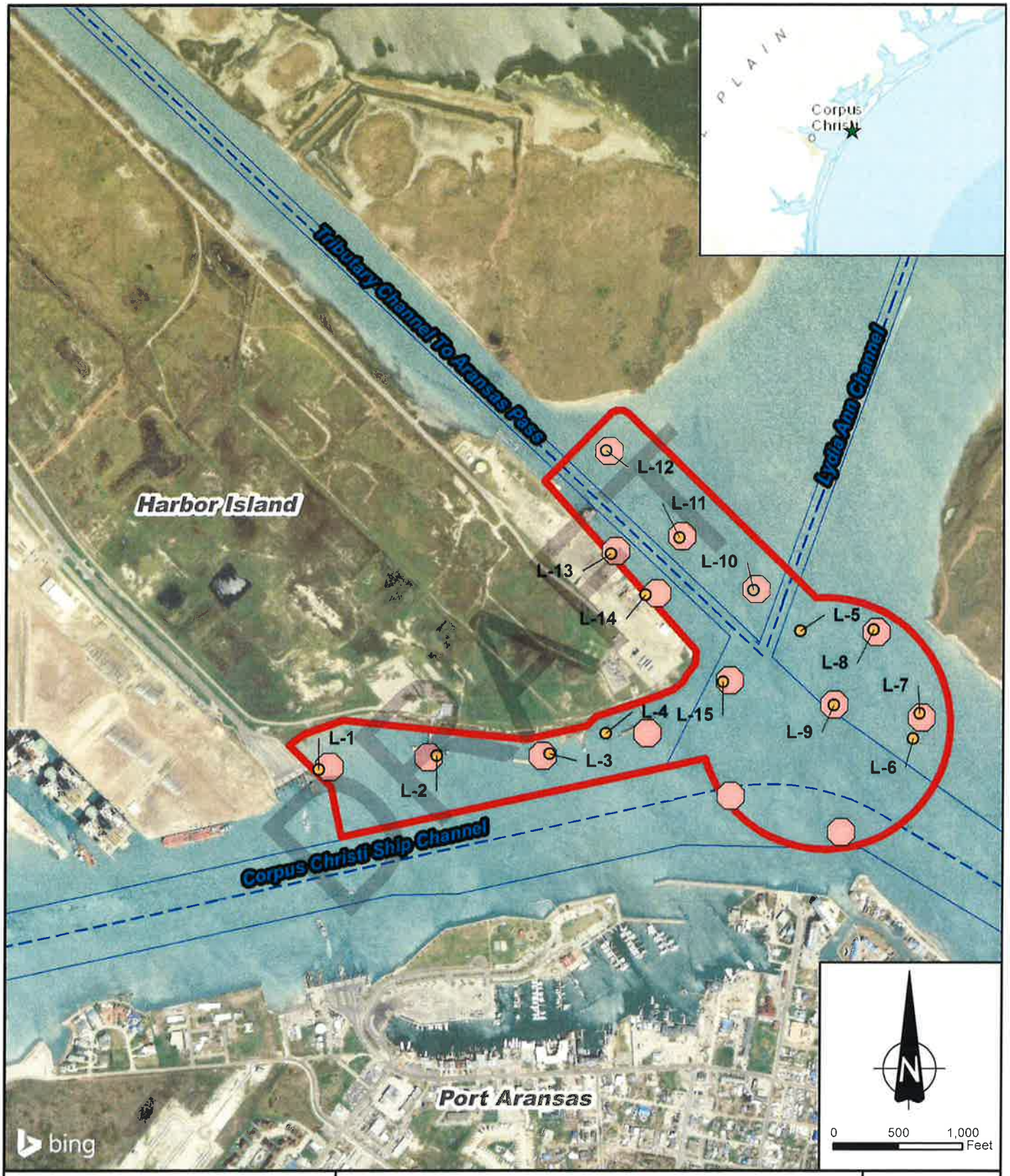

PCCA Harbor Island Permit Application
Sample Locations

PORT CORPUS CHRISTI

wood.

- Actual Sample Locations
- Proposed Sample Locations
- Project Boundary
- Toe of Channel
- Centerline of Channels
- Site Location

DATE	JUNE 2019
SCALE	1 " = 1,000 feet
PROJECT NO.	6703180051
FIGURE	2

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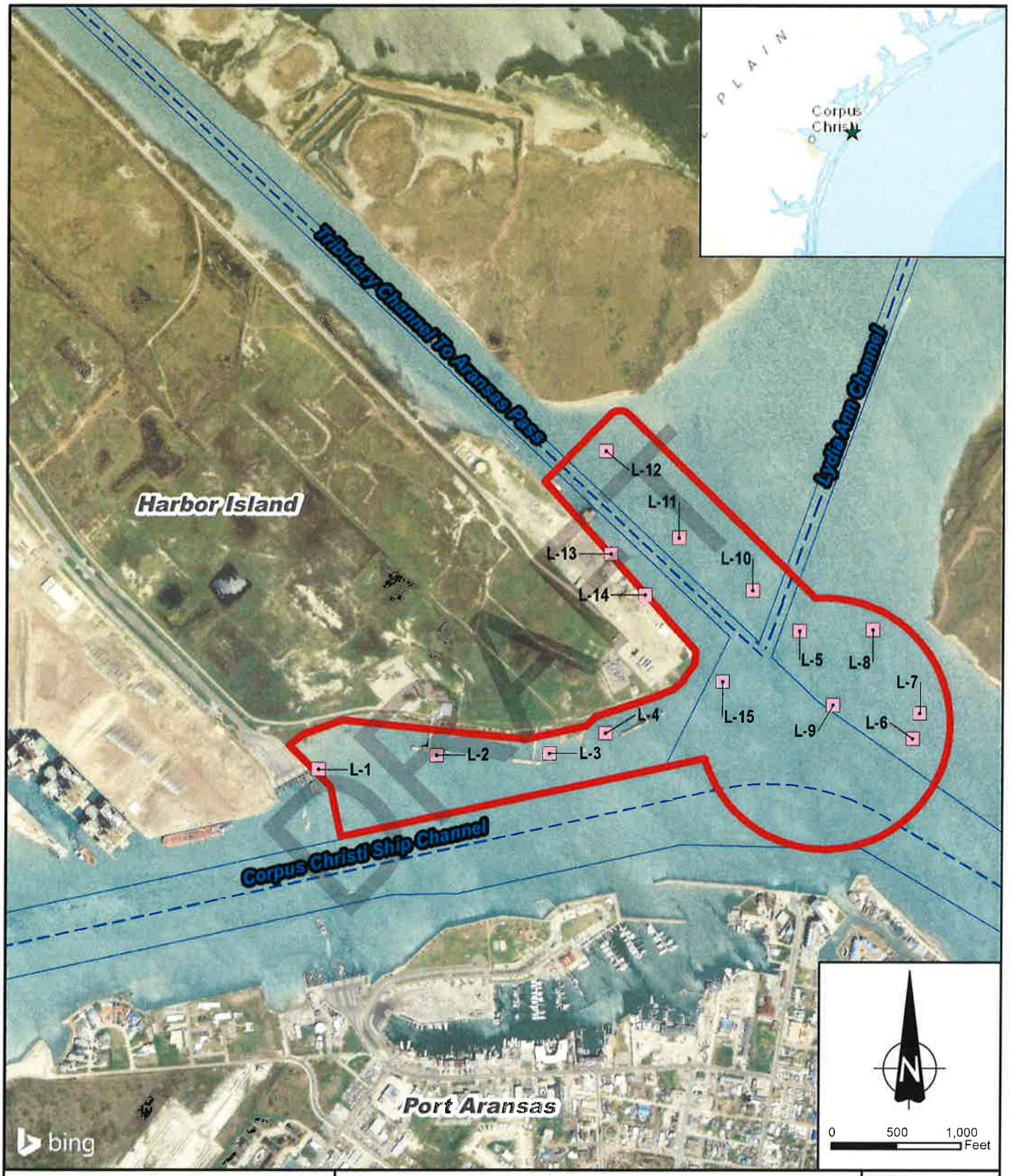
\\wp-fs-arcgis-1.woodgroup.com\GIS_Projects\01_Projects\EIS_Projects\Turnpike\03_EXHIBITS\2019_04_23_Figures\Figure 2 - Project Turnpike Sample Locations\2019_06_12\Sample_Locations.mxd - stacy.brooks - 6/12/2019 - 10:47:39 AM



PCCA Harbor Island
Permit Application Sediment and Benthic Invertebrate Sample Locations

PORT CORPUS CHRISTI

wood.

- Benthic and Sediment Sample Locations
- Project Boundary
- Toe of Channel
- Centerline of Channels
- Site Location

DATE	JUNE 2019
SCALE	1 " = 1,000 feet
PROJECT NO.	6703180051
FIGURE	3

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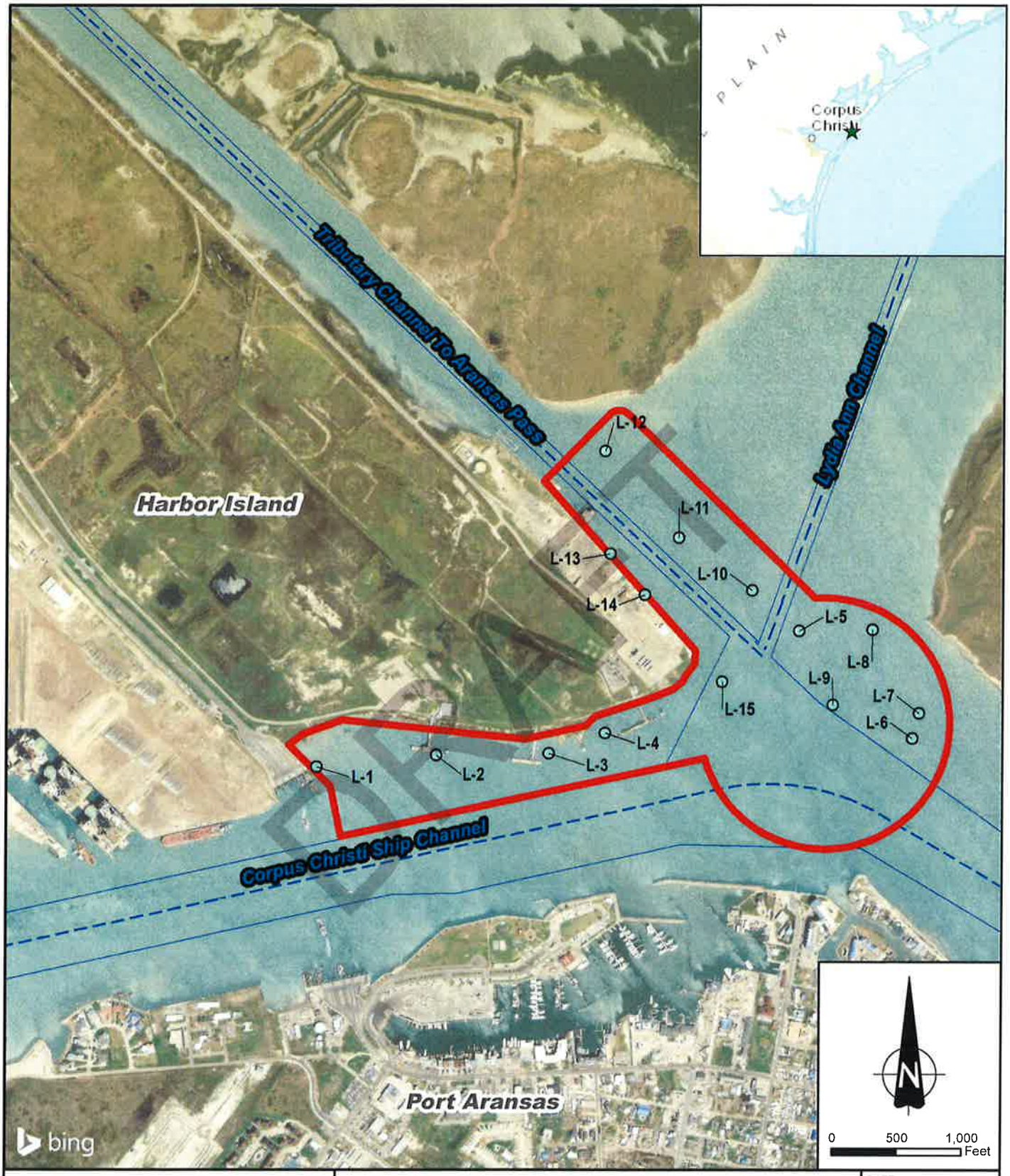
\\wp-fs-arcgis-1.woodgroup.com\GIS_Projects\01_Projects\EIS_Projects\Turnpike\03_EXHIBITS\2019_04_23_Figures\Figure 3 - Project Turnpike Sediment and Benthic Invertebrate Sample Locations\2019_06_12\Sediment_and_Benthic_Invertebrate_Sample_Locations.mxd - stacy.brooks - 6/12/2019 - 10:45:59 AM



PCCA Harbor Island Permit Application
Water Quality Sample Locations

PORT CORPUS CHRISTI

wood.

- Water Quality Measurement Locations
- Project Boundary
- Toe of Channel
- Centerline of Channels
- Site Location

DATE	JUNE 2019
SCALE	1 " = 1,000 feet
PROJECT NO.	6703180051
FIGURE	4

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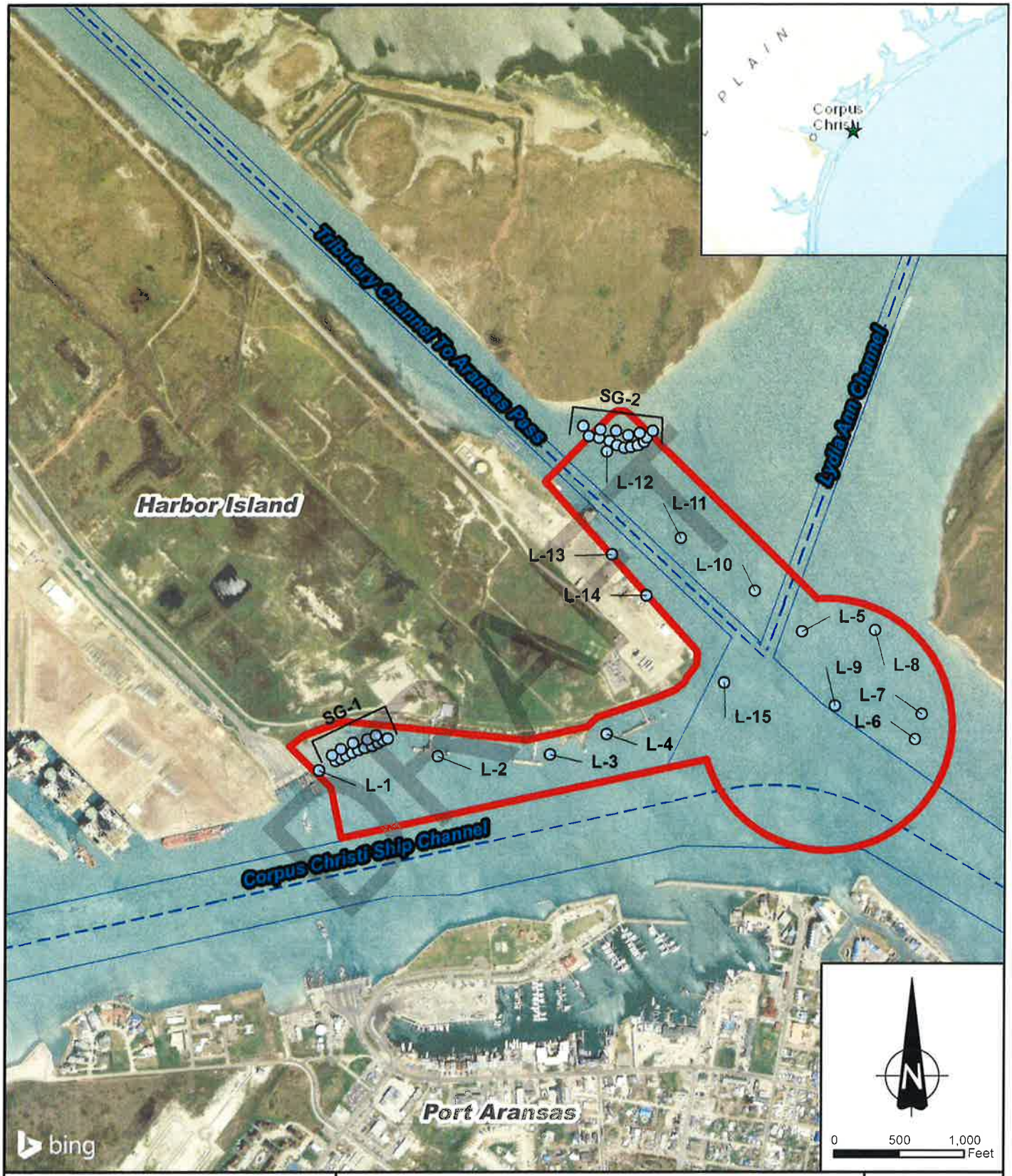
liwp-fs-arcgis-1.woodgroup.com\GIS_Projects\01_Projects\EIS_Projects\Turnpike\03_EXHIBITS\2019_04_23_Figures\Figure 4 - Project Turnpike Water Quality Sample Locations\2019_06_12\Water_Quality_Sample_Locations.mxd - stacy.brooks - 6/12/2019 - 10:51:53 AM



PCCA Harbor Island Permit Application
Seagrass Sample Locations

PORT CORPUS CHRISTI

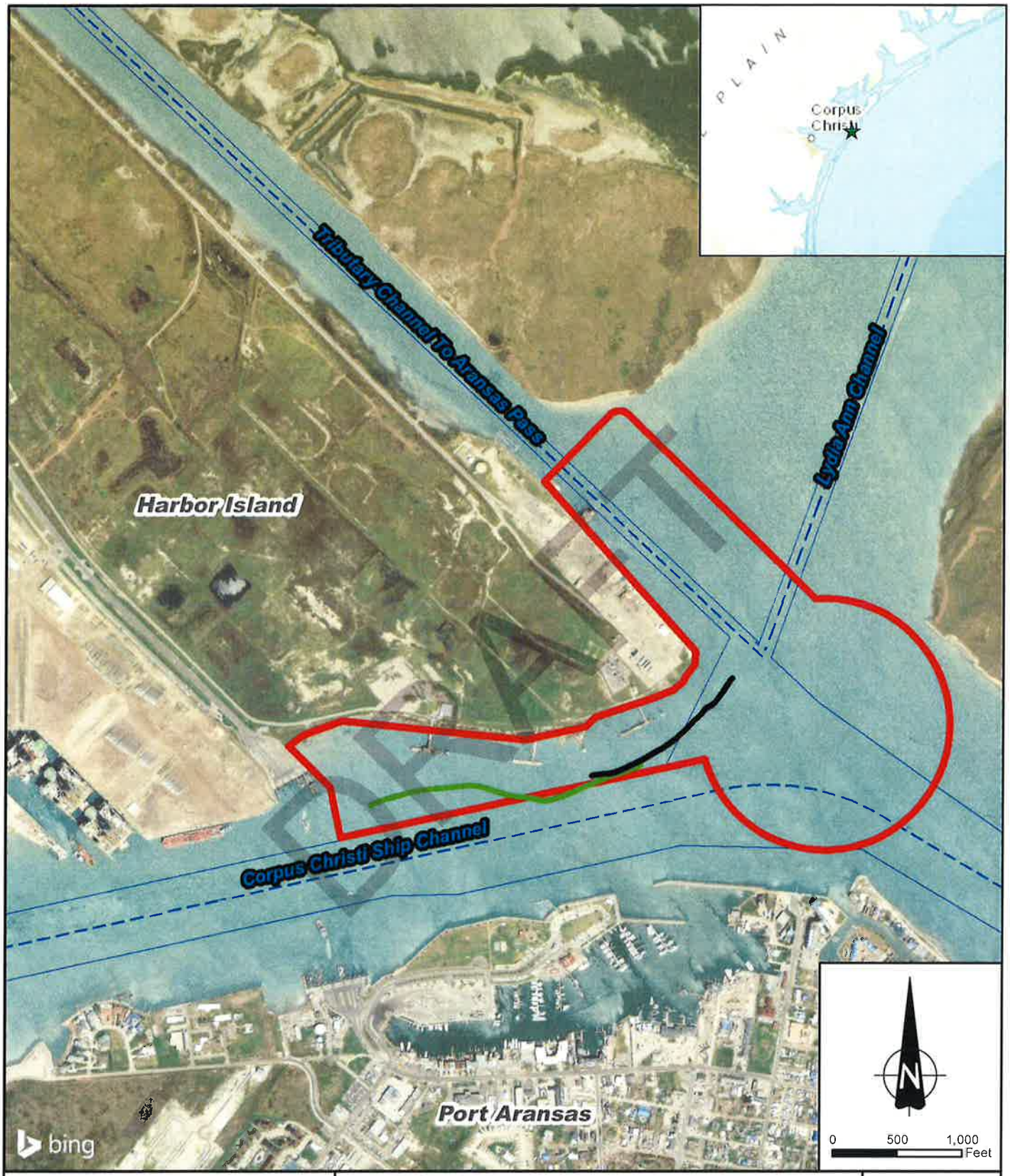
wood.

- Sea Grass Sample Locations
- Project Boundary
- Toe of Channel
- Centerline of Channels
- Site Location

DATE	JUNE 2019
SCALE	1 " = 1,000 feet
PROJECT NO.	6703180051
FIGURE	5

DRAWN BY: SB CHECKED BY: AB

\\wp-fs-arcgis-1.woodgroup.com\GIS_Projects\01_Projects\EIS_Projects\Turnpike\03_EXHIBITS\2019_04_23_Figures\Figure 5 - Project Turnpike Seagrass Sample Locations\2019_06_12\Seagrass_Sample_Locations_mxd - stacy.brooks - 6/12/2019 - 10:53:21 AM



PCCA Harbor Island Permit Application
Marine Life and Plankton Sample Transects

PORT CORPUS CHRISTI

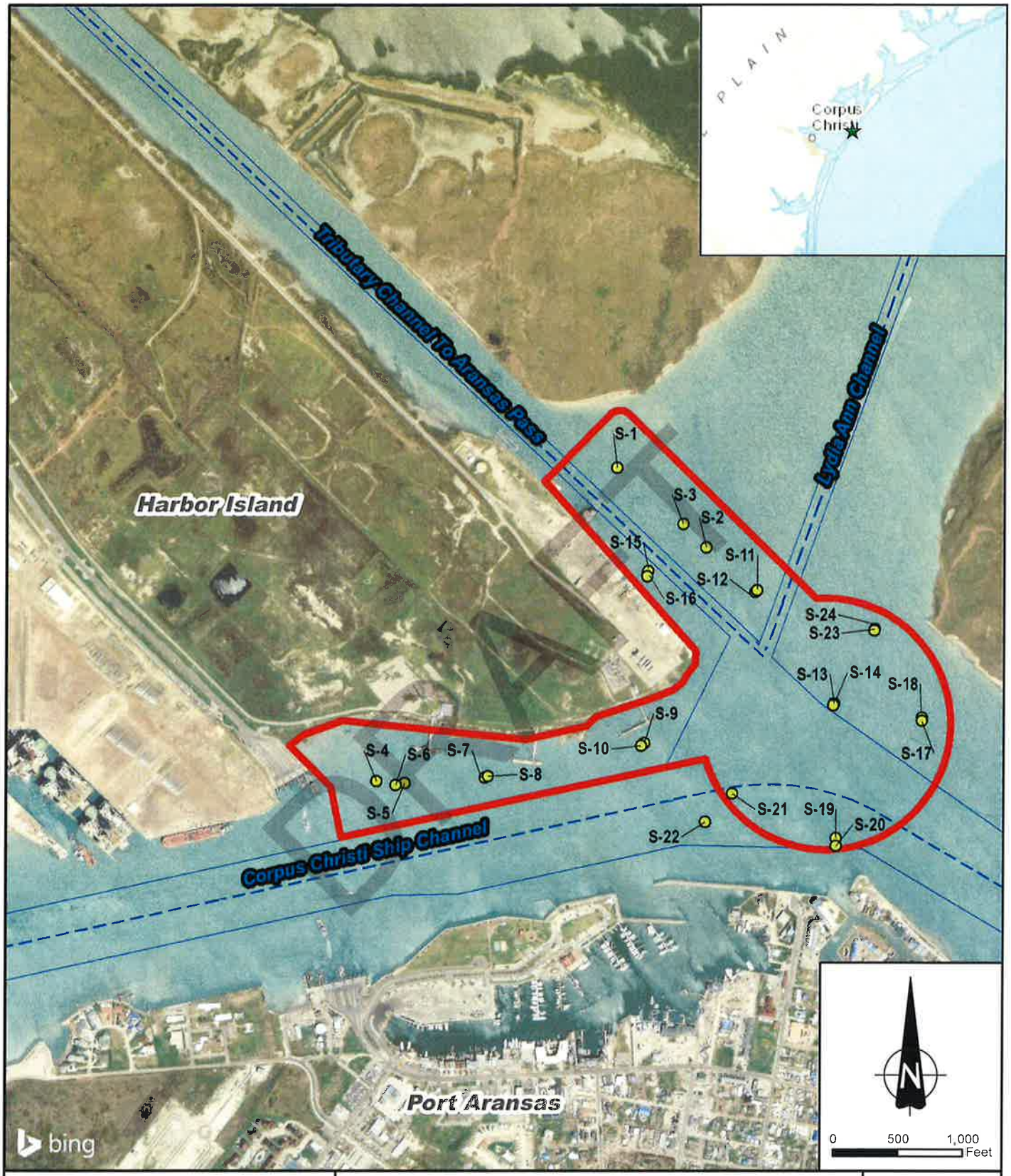
wood.

- Plankton Net Transect 1
- Plankton Net Transect 2
- Project Boundary
- Toe of Channel
- Centerline of Channels
- Site Location

DATE	JUNE 2019
SCALE	1 " = 1,000 feet
PROJECT NO.	6703180051
FIGURE	6

DRAWN BY: SB CHECKED BY: AB

\\wp-fs-arcgis-1.woodgroup.com\GIS_Projects\01_Projects\EIS_Projects\Turnpike\03_EXHIBITS\2019_04_23_Figures\Figure 6 - Project Turnpike Marine Life and Plankton Sample Transects\20190612\Marine_Life_and_Plankton_Sample_Transects.mxd - stacy.brooks - 6/12/2019 - 10:54:32 AM



PCCA Harbor Island Permit Application
Water Velocity Sample Locations

PORT CORPUS CHRISTI

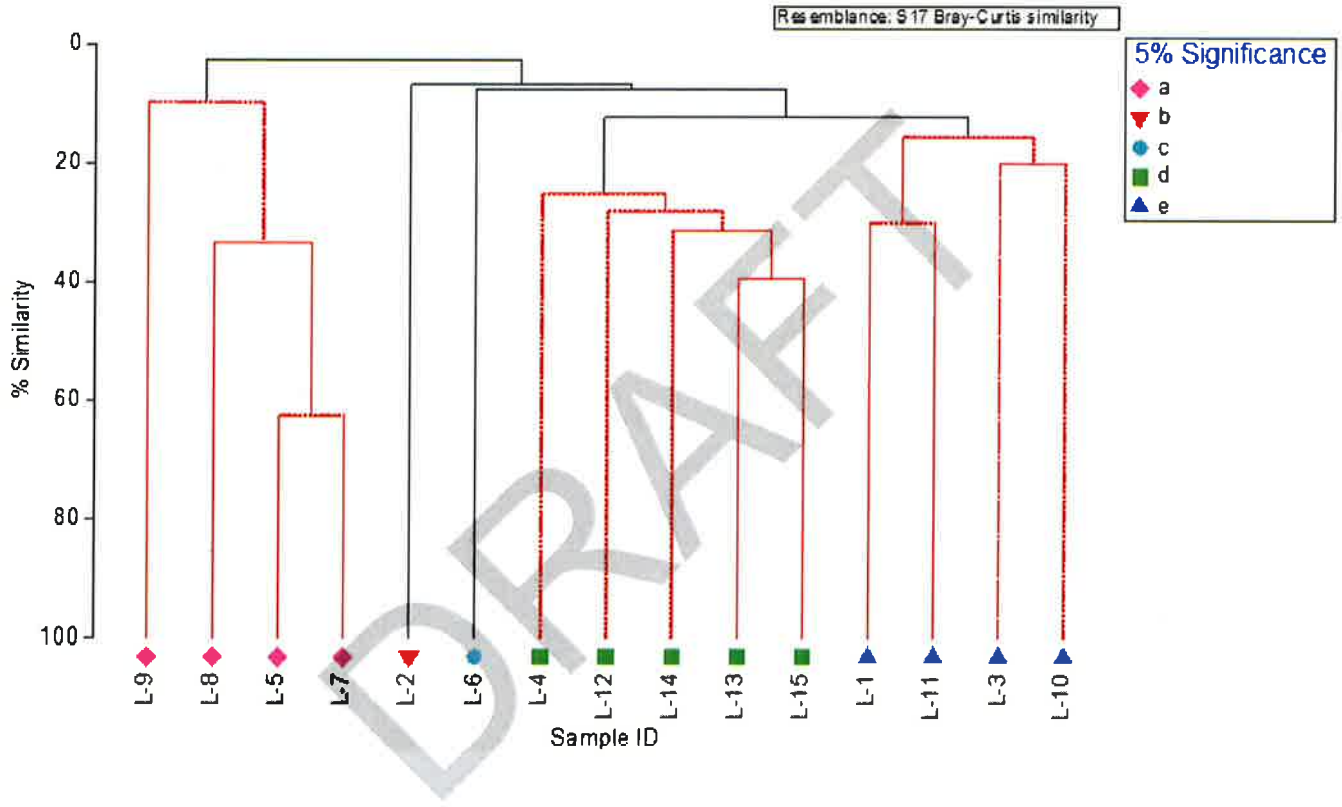
wood.

- Water Velocity Measurement Locations
- Project Boundary
- Toe of Channel
- Centerline of Channels
- Site Location

DATE	JUNE 2019
SCALE	1 " = 1,000 feet
PROJECT NO.	6703180051
FIGURE	7

DRAWN BY: SB CHECKED BY: AB

\\wp-fs-arcgis-1.woodgroup.com\GIS_Projects\01_Projects\EIS_Projects\Turnpike\03_EXHIBITS\2019_04_23_Figures\Figure 7 - Project Turnpike Water Velocity Sample Locations\20190612\Water_Velocity_Sample_Locations.mxd - stacy.brooks - 6/12/2019 - 10:54:54 AM



PCCA Harbor Island Permit Application
Dendrogram Results from the CLUSTER Analysis of the Benthic Macroinvertebrate Samples

PORT CORPUS CHRISTI

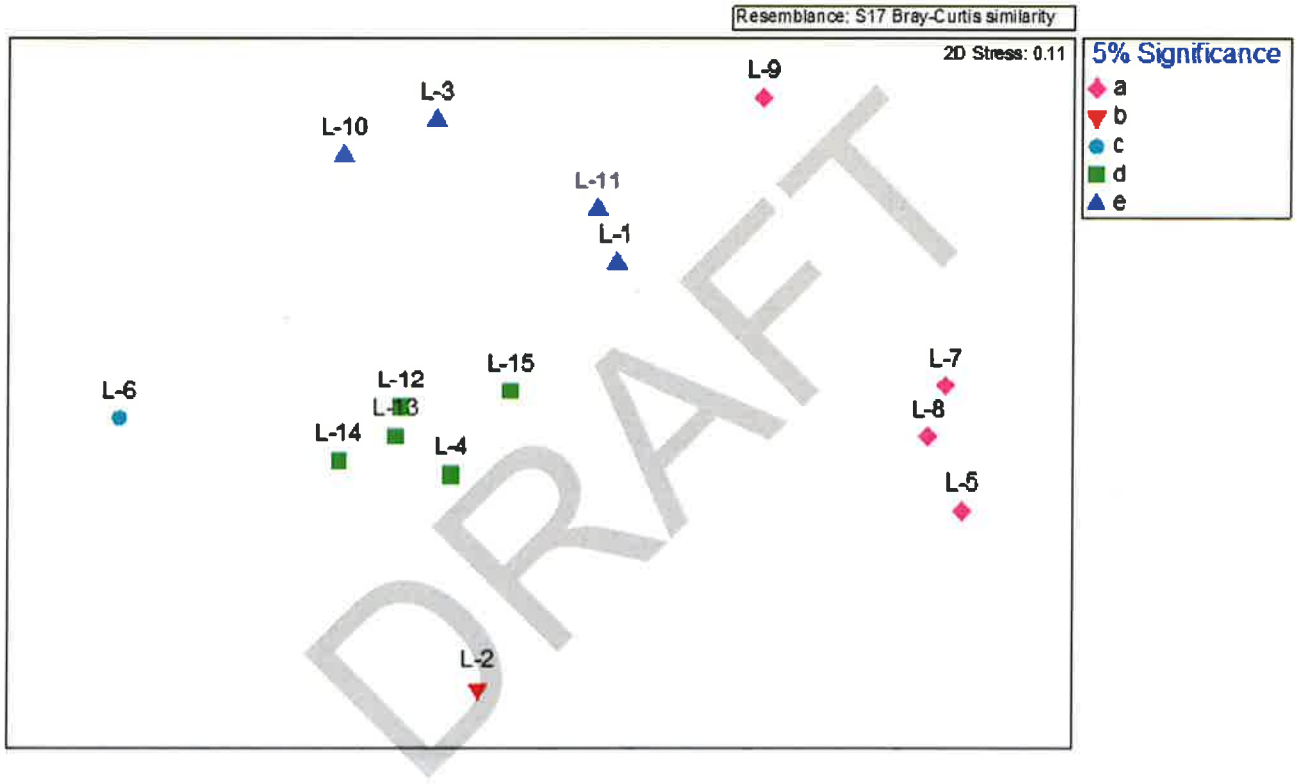
wood.

Dendrogram results from the CLUSTER analysis of the benthic macroinvertebrate samples. Solid black lines indicated significant differences at $p < 0.05$, while red dotted lines indicated insignificant differences with $p > 0.05$. The SIMPROF option was used to create a factor illustrating which sample groups were significantly different from others (listed in the key above) at the 5% significance level.

DATE	JUNE 2019
SCALE	N/A
PROJECT NO.	6703180051
FIGURE	8

DRAWN BY: SD CHECKED BY: AB

\\wp-fs-arcgis-1.woodgroup.com\GIS_Projects\01_Projects\EIS_Projects\Turnpike\03_EXHIBITS\2019_04_23_Figures\Figure 8 - Dendrogram Results from the CLUSTER Analysis of the Benthic Macroinvertebrate Samples\20190612\Dendrogram_Cluster_Analysis_Macro.mxd - stacy.brooks - 6/12/2019 - 10:56:16 AM



PCCA Harbor Island Permit Application
Two-Dimensional nMDS

PORT CORPUS CHRISTI®

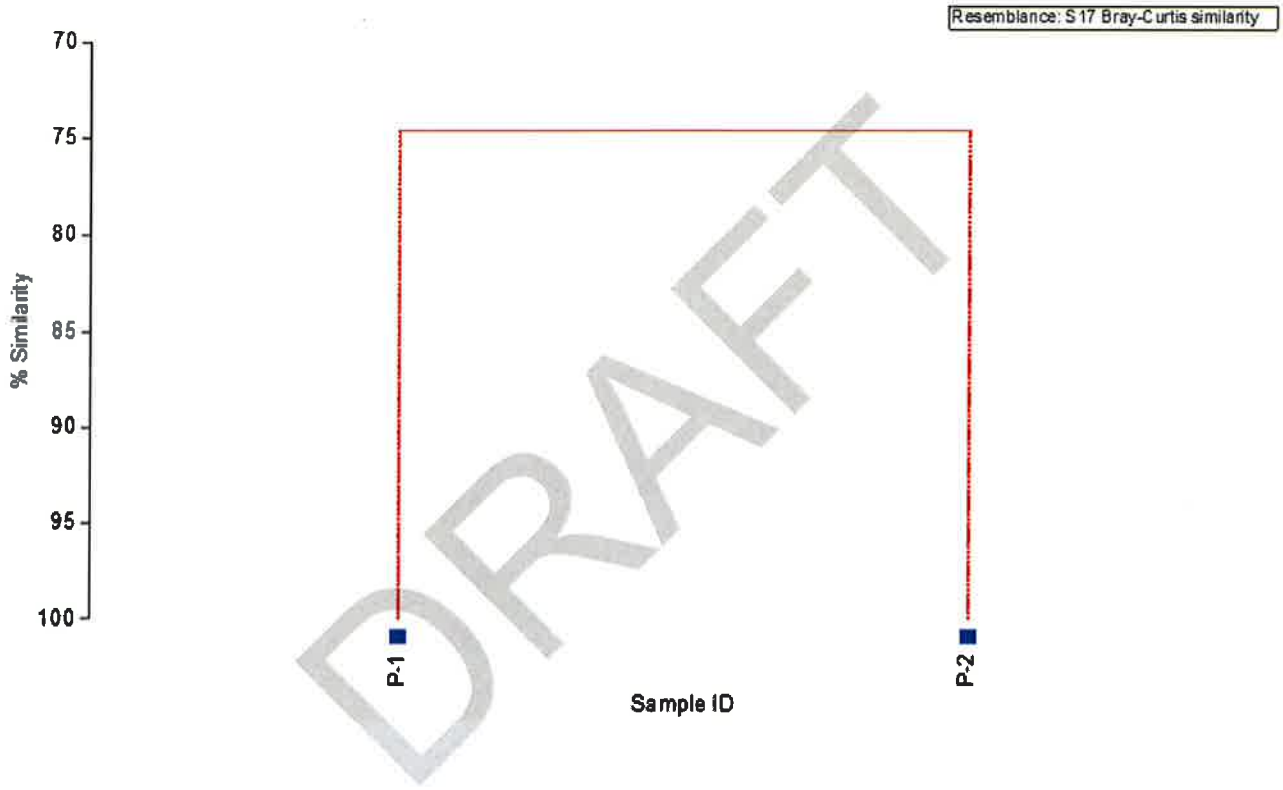
wood.

Two-dimensional nMDS plot of benthic macroinvertebrate samples with the 5% significance level as a factor.

DATE	JUNE 2019
SCALE	N/A
PROJECT NO.	6703180051
FIGURE	9

DRAWN BY: SB CHECKED BY: AB

\\wp-fs-arcgis-1.woodgroup.com\GIS_Projects\01_Projects\EIS_Projects\Turnpike\03_EXHIBITS\2019_04_23_Figures\Figure 9 - Two Dimensional nMDS\20190612\Two_Dimensional_nMDS_P.mxd - stacy.brooks - 6/12/2019 - 10:57:48 AM



PCCA Harbor Island Permit Application Dendrogram Results from the CLUSTER Analysis with the SIMPROF Option of the Plankton Samples PORT CORPUS CHRISTI® wood.	Dendrogram results from the CLUSTER analysis with the SIMPROF option of the plankton samples. Solid black lines indicated significant differences at $p < 0.05$, while red dotted lines indicated insignificant differences with $p > 0.05$.	DATE: JUNE 2019 SCALE: N/A PROJECT NO.: 6703180051 FIGURE: 10

DRAWN BY: SB CHECKED BY: AB

TABLES

TABLE 1
SUMMARY OF SAMPLE COLLECTION SITES AND ANALYSES
PORT OF CORPUS CHRISTI AUTHORITY
PROJECT TURNPIKE

Location	GPS Coordinates (Proposed)		GPS Coordinates (Actual)	
	North	West	North	West
L-1	27.844318	-97.069441	27.84427	-97.06970
L-2	27.844493	-97.067105	27.84454	-97.06691
L-3	27.844501	-97.064404	27.84455	-97.06424
L-4	27.844950	-97.061924	27.84496	-97.06291
L-5	27.843608	-97.059952	27.84707	-97.05827
L-6[a]	27.842822	-97.057325	27.84478	-97.05560
L-7	27.845212	-97.055378	27.84531	-97.05544
L-8	27.847017	-97.056448	27.84708	-97.05653
L-9	27.845511	-97.057463	27.84550	-97.05749
L-10	27.847944	-97.059301	27.84793	-97.05938
L-11	27.849084	-97.061056	27.84906	-97.06112
L-12	27.850885	-97.062762	27.85090	-97.06284
L-13	27.848790	-97.062619	27.84874	-97.06274
L-14	27.847891	-97.061656	27.84787	-97.06194
L-15	27.846039	-97.059951	27.84602	-97.06012

FOOTNOTES:

[a]Unable to collect sediment sample from L-6: there were 14 ponar drops (4 on port side, 10 on starboard side) which only yielded shell hash.

TABLE 2
SEDIMENT SAMPLING PARAMETERS
PORT OF CORPUS CHRISTI AUTHORITY
PROJECT TURNPIKE

Location	Date	Time	Depth to Sediment (ft)	Top of Sediment Elevation MLLW (ft)	Description	GPS Coordinates (Actual)	
						North	West
L-1	02/04/19	1155	3.3	-2.47	dark gray silty mud	27.84427	-97.06970
L-2	02/05/19	1015	22.3	-21.60	dark gray, sand and mud, 1 strand of seagrass	27.84454	-97.06691
L-3	02/05/19	1055	13.4	-12.71	dark gray, clay, sandy, shell hash	27.84455	-97.06424
L-4	02/05/19	1515	28.5	-27.28	dark gray, clayey sand, some shell	27.84496	-97.06291
L-5	02/05/19	1620	20.9	-19.40	gray, fine-grained sand	27.84707	-97.05827
L-6[a]	02/06/19	1538	35.8	-34.27	--	27.84478	-97.05560
L-7	02/04/19	1530	16.3	-14.72	gray sand and mud	27.84531	-97.05544
L-8	02/04/19	1440	16.8	-15.54	gray sand and mud	27.84708	-97.05653
L-9	02/06/19	1505	44.9	-43.49	brownish gray sand and mud	27.84550	-97.05749
L-10	02/06/19	1407	34.8	-33.51	brownish gray, fine-grained sand with clay	27.84793	-97.05938
L-11	02/05/19	1400	25.5	-24.3	gray sand with clay	27.84906	-97.06112
L-12	02/04/19	1325	6.9	-5.74	dark gray sandy mud	27.85090	-97.06284
L-13	02/05/19	1251	28.0	-26.99	dark gray, sand and mud, shell hash	27.84874	-97.06274
L-14	02/05/19	1200	27.5	-26.71	dark gray, sand and mud, some shell hash, 1 strand of seagrass	27.84787	-97.06194
L-15	02/06/19	1305	53.5	-52.48	dark gray, muddy sand	27.84602	-97.06012

FOOTNOTES:

[a]Unable to collect sediment sample from L-6: there were 14 ponar drops (4 on port side, 10 on starboard side) which only yielded shell hash.

TABLE 3
SEDIMENT ANALYTICAL DATA
PORT OF CORPUS CHRISTI AUTHORITY
PROJECT TURNPIKE

Location	Date	Total Organic Carbon (weight%-dry)	Grain Size Analysis							
			% ≥3"	% Gravel		% Sand			% Fines	
				Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
L-1	02/04/19	0.0630	0.0	0.0	0.0	0.0	0.5	89.1	7.9	2.5
L-2	02/05/19	0.475	0.0	0.0	0.0	0.0	0.1	63.4	20.2	16.3
L-3	02/05/19	0.407	0.0	0.0	0.0	0.0	5.1	74.3	9.8	10.8
L-4	02/05/19	0.319	0.0	0.0	31.1	8.9	1.7	31.2	15.2	11.9
L-5	02/05/19	<0.0600	0.0	0.0	0.0	0.0	0.1	95.9	2.0	2.0
L-6[a]	02/06/19	--	--	--	--	--	--	--	--	--
L-7	02/04/19	<0.0600	0.0	0.0	0.0	0.0	0.4	95.0	3.1	1.5
L-8	02/04/19	<0.0600	0.0	0.0	0.0	0.0	0.2	95.6	2.7	1.5
L-9	02/06/19	<0.0600	0.0	0.0	0.0	0.0	0.6	92.7	4.2	2.5
L-10	02/06/19	0.0670	0.0	0.0	0.0	0.0	0.3	91.8	5.9	2.0
L-11	02/05/19	0.515	0.0	0.0	0.0	0.0	3.9	89.6	3.0	3.5
L-12	02/04/19	0.161	0.0	1.2	19.9	0.0	3.6	66.8	5.3	3.2
L-13	02/05/19	0.494	0.0	0.0	59.6	0.0	6.8	28.7	2.1	2.8
L-14	02/05/19	0.264	0.0	0.0	0.0	0.0	3.2	78.6	7.3	10.9
L-15	02/06/19	<0.0600	0.0	0.0	0.0	0.0	0.1	43.4	53.1	3.4

Footnotes:

[a]Unable to collect sediment sample from L-6: there were 14 ponar drops (4 on port side, 10 on starboard side) which only yielded shell hash.

TABLE 4
BENTHIC AND PLANKTON SAMPLE DIVERSITY PARAMETERS
PORT OF CORPUS CHRISTI AUTHORITY
PROJECT TURNPIKE

Sample Type	Sample ID	Date	Total # of Taxa (S)	Total # of Individuals per Unit Area* (N)	Margalef's Richness (d)	Pielow's Evenness (J')	Shannon's Diversity ($H'(\log_e)$)	Simpson's Diversity (1-λ')
Benthic	L-1	02/04/19	11	775.00	3.46	0.91	2.18	0.91
	L-2	02/05/19	59	31172.28	8.81	0.59	2.41	0.80
	L-3	02/05/19	11	516.67	4.02	0.99	2.37	0.98
	L-4	02/05/19	30	2798.62	6.95	0.89	3.04	0.94
	L-5	02/05/19	5	344.45	1.92	0.86	1.39	0.79
	L-6	02/06/19	51	9601.41	9.25	0.74	2.91	0.86
	L-7	02/04/19	3	344.45	0.96	0.67	0.74	0.46
	L-8	02/04/19	4	301.39	1.54	0.92	1.28	0.81
	L-9	02/06/19	5	258.33	2.23	0.97	1.56	0.93
	L-10	02/06/19	21	1205.56	6.00	0.96	2.92	0.97
	L-11	02/05/19	11	947.22	3.24	0.91	2.17	0.90
	L-12	02/04/19	55	4650.01	11.53	0.91	3.63	0.97
	L-13	02/05/19	28	3745.84	6.05	0.88	2.92	0.94
	L-14	02/05/19	37	6329.18	7.21	0.69	2.51	0.85
	L-15	02/06/19	30	2583.34	7.08	0.91	3.08	0.95
Plankton	P-1	02/06/19	30	228.43	2.96	0.38	1.29	0.46
	P-2	02/06/19	24	186.78	2.46	0.51	1.61	0.61

* Unit area is per square meter and per cubic meter for benthic and plankton samples, respectively.

TABLE 5
WATER QUALITY PARAMETERS
PORT OF CORPUS CHRISTI AUTHORITY
PROJECT TURNPIKE

Location	Date	Depth to Sediment	Time	Depth of Sample (ft. below water surface)	Elevation (MLLW)[a]	Water Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	GPS Coordinates (Actual)		Section of Project Area
									North	West	
L-1	02/04/19	3.3	1614	2.8	-1.97	16.62	23.81	4.92	27.84432	-97.06974	Corpus Christi Ship Channel
L-2	02/05/19	22.3	1001	5.0	-4.30	15.67	21.28	6.27	27.84454	-97.06691	Corpus Christi Ship Channel
			1004	10.0	-9.30	15.64	21.28	7.79			
			1007	15.0	-14.30	15.68	21.29	7.68			
			1010	20.0	-19.30	15.81	21.36	7.65			
L-3	02/05/19	13.4	1045	5.0	-4.31	16.41	19.96	5.78	27.84455	-97.06424	Corpus Christi Ship Channel
			1048	10.0	-9.31	16.03	21.41	6.26			
L-4	02/05/19	28.5	1458	5.0	-3.78	16.94	17.02	5.78	27.84496	-97.06291	Corpus Christi Ship Channel
			1501	10.0	-8.78	16.71	18.02	5.73			
			1504	15.0	-13.78	16.69	18.28	5.72			
			1507	20.0	-18.78	16.61	19.08	4.65			
			1510	25.0	-23.78	16.29	21.59	4.61			
L-5	02/05/19	20.9	1603	5.0	-3.50	16.47	18.38	5.92	27.84707	-97.05827	Turning Basin
			1606	10.0	-8.50	16.11	20.74	5.87			
			1609	15.0	-13.50	16.04	20.98	5.86			
			1612	20.0	-18.50	16.09	21.10	6.20			
L-6	02/06/19	35.8	1542	5.0	-3.47	16.87	16.22	6.20	27.84478	-97.05560	Turning Basin
			1545	10.0	-8.47	16.82	16.42	5.89			
			1548	15.0	-13.47	16.81	16.80	6.19			
			1551	20.0	-18.47	16.76	17.41	5.83			
			1554	25.0	-23.47	16.75	17.51	5.95			
			1557	30.0	-28.47	16.76	17.45	5.82			
L-7	02/04/19	16.3	1514	5.0	-3.42	16.05	22.48	4.29	27.84531	-97.05544	Turning Basin
			1517	10.0	-8.42	15.91	24.67	4.25			
			1520	15.0	-13.42	15.87	25.07	4.57			
L-8	02/04/19	16.8	1422	5.0	-3.74	16.01	20.63	6.16	27.84708	-97.05653	Turning Basin
			1426	10.0	-8.74	15.94	21.99	6.15			
			1430	15.0	-13.74	15.96	23.25	6.08			

TABLE 5
WATER QUALITY PARAMETERS
PORT OF CORPUS CHRISTI AUTHORITY
PROJECT TURNPIKE

Location	Date	Depth to Sediment	Time	Depth of Sample (ft. below water surface)	Elevation (MLLW)[a]	Water Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	GPS Coordinates (Actual)		Section of Project Area
									North	West	
L-9	02/06/19	44.9	1441	5.0	-3.59	16.76	15.52	6.31	27.84550	-97.05749	Turning Basin
			1444	10.0	-8.59	16.76	16.25	5.96			
			1447	15.0	-13.59	16.71	17.42	6.19			
			1450	20.0	-18.59	16.78	17.57	6.17			
			1453	25.0	-23.59	16.86	17.68	6.01			
			1456	30.0	-28.59	16.76	17.92	6.19			
			1459	35.0	-33.59	16.73	17.95	5.90			
			1502	40.0	-38.59	16.72	17.96	5.93			
L-10	02/06/19	34.8	1351	5.0	-3.71	16.91	15.37	6.02	27.84793	-97.05938	Tributary Channel to Aransas Pass
			1354	10.0	-8.71	16.90	15.32	6.06			
			1357	15.0	-13.71	16.81	15.33	5.98			
			1400	20.0	-18.71	16.79	15.46	6.31			
			1403	25.0	-23.71	16.77	16.46	6.06			
			1406	30.0	-28.71	16.68	17.29	5.84			
L-11	02/05/19	25.5	1347	5.0	-3.80	16.13	15.78	6.21	27.84906	-97.06112	Tributary Channel to Aransas Pass
			1350	10.0	-8.80	16.62	16.17	5.78			
			1353	15.0	-13.80	16.72	16.22	6.11			
			1356	20.0	-18.80	17.06	17.59	5.62			
			1359	25.0	-23.80	16.12	19.19	5.68			
L-12	02/04/19	6.9	1350	5.0	-3.84	16.26	20.32	4.64	27.85090	-97.06284	Tributary Channel to Aransas Pass
L-13	02/05/19	28.0	1221	5.0	-3.99	17.02	16.51	6.12	27.84874	-97.06274	Tributary Channel to Aransas Pass
			1224	10.0	-8.99	17.62	17.67	7.01			
			1227	15.0	-13.99	17.73	17.84	6.99			
			1230	20.0	-18.99	17.78	17.92	6.99			
			1232	25.0	-23.99	17.82	17.97	7.09			

TABLE 5
WATER QUALITY PARAMETERS
PORT OF CORPUS CHRISTI AUTHORITY
PROJECT TURNPIKE

Location	Date	Depth to Sediment	Time	Depth of Sample (ft. below water surface)	Elevation (MLLW)[a]	Water Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	GPS Coordinates (Actual)		Section of Project Area
									North	West	
L-14	02/05/19	27.5	1141	5.0	-4.21	16.92	16.73	6.99	27.84787	-97.06194	Tributary Channel to Aransas Pass
			1144	10.0	-9.21	16.92	16.73	6.18			
			1147	15.0	-14.21	17.19	17.18	6.79			
			1150	20.0	-19.21	17.75	18.04	7.05			
			1153	25.0	-24.21	17.75	18.06	7.04			
L-15	02/06/19	53.5	1246	5.0	-3.98	17.62	15.71	7.30	27.84602	-97.06012	Turning Basin
			1249	10.0	-8.98	17.34	15.79	6.83			
			1252	15.0	-13.98	17.04	16.00	6.89			
			1255	20.0	-18.98	16.83	16.57	6.94			
			1258	25.0	-23.98	16.70	16.69	6.56			
			1321 (a)	30.0	-28.98	16.66	17.21	6.15			
			1324	35.0	-33.98	16.63	17.63	6.28			
			1327	40.0	-38.98	16.60	17.78	6.01			
			1330	45.0	-43.98	16.60	18.04	6.30			
			1333	50.0	-48.98	16.62	18.06	6.19			

FOOTNOTES:

[a]MLLW calculated using water level data from NOAA Tides and Currents Website; Port Aransas, Texas, Station ID: 8775237

TABLE 6
SEAGRASS/OYSTER ASSESSMENT
PORT OF CORPUS CHRISTI AUTHORITY
PROJECT TURNPIKE

SG-1 Location	GPS Coordinates (Actual)		Date	Time	Seagrass Present	Genus Description	Oysters Present
	North	West					
1-1	27.8444638	-97.0692948	02/07/19	1319	Absent	--	Absent
1-2	27.8445089	-97.0691706	02/07/19	1321	Absent	--	Absent
1-3	27.8445728	-97.0690468	02/07/19	1322	Absent	--	Absent
1-4	27.8446371	-97.0689096	02/07/19	1323	Absent	--	Absent
1-5	27.8446882	-97.0687655	02/07/19	1323	Absent	--	Absent
1-6	27.8447276	-97.0686111	02/07/19	1324	Absent	--	Absent
1-7	27.8447654	-97.0684378	02/07/19	1325	Absent	--	Absent
1-8	27.8448309	-97.0683039	02/07/19	1326	Absent	--	Absent
1-9	27.8448833	-97.0681927	02/07/19	1327	Absent	--	Absent
1-10	27.8449196	-97.0680758	02/07/19	1329	Absent	--	Absent
1-11	27.8445801	-97.0693803	02/07/19	1330	Absent	--	Absent
1-12	27.8447131	-97.0691747	02/07/19	1331	Absent	--	Absent
1-13	27.8448311	-97.0688794	02/07/19	1332	Absent	--	Absent
1-14	27.8449061	-97.0685487	02/07/19	1333	Absent	--	Absent
1-15	27.8449831	-97.0683574	02/07/19	1334	Absent	--	Absent

SG-2 Location	GPS Coordinates (Actual)		Time	Time	Seagrass Present	Genus Description	Oysters Present
	N	W					
2-1	27.8512259	-97.0632498	02/07/19	1350	Slight Presense	2 strands of Halodule	Absent
2-2	27.8511793	-97.0630166	02/07/19	1351	Absent	--	Absent
2-3	27.8511198	-97.0627718	02/07/19	1352	Absent	--	Absent
2-4	27.8510258	-97.0625961	02/07/19	1354	Absent	--	Absent
2-5	27.8509690	-97.0624241	02/07/19	1355	Absent	--	Absent
2-6	27.8509815	-97.0622654	02/07/19	1356	Absent	--	Absent
2-7	27.8510183	-97.0620960	02/07/19	1357	Absent	--	Absent
2-8	27.8510912	-97.0619529	02/07/19	1358	Absent	--	Absent
2-9	27.8511843	-97.0618898	02/07/19	1359	Absent	--	Absent
2-10	27.8513152	-97.0617466	02/07/19	1400	Absent	--	Absent
2-11	27.8512723	-97.0620545	02/07/19	1402	Absent	--	Absent
2-12	27.8512344	-97.0623265	02/07/19	1403	Absent	--	Absent
2-13	27.8513289	-97.0626104	02/07/19	1405	Absent	--	Absent
2-14	27.8513605	-97.0629851	02/07/19	1406	Absent	--	Absent
2-15	27.8514359	-97.0633794	02/07/19	1408	Absent	--	Absent

Original Locations	GPS Coordinates (Actual)		Date	Time	Seagrass Present	Genus Description	Oysters Present
	N	W					
L-1	27.84427	-97.06970	02/04/19	1155	Absent	--	Absent
L-2	27.84454	-97.06691	02/05/19	1015	Slight Presense	1 strand of Halodule	Absent
L-3	27.84455	-97.06424	02/05/19	1055	Absent	--	Absent
L-4	27.84496	-97.06291	02/05/19	1515	Absent	--	Absent
L-5	27.84707	-97.05827	02/05/19	1620	Absent	--	Absent
L-6	27.84478	-97.05560	02/06/19	1600	Absent	--	Absent
L-7	27.84531	-97.05544	02/04/19	1530	Absent	--	Absent
L-8	27.84708	-97.05653	02/04/19	1440	Absent	--	Absent
L-9	27.84550	-97.05749	02/06/19	1505	Absent	--	Absent
L-10	27.84793	-97.05938	02/06/19	1407	Absent	--	Absent
L-11	27.84906	-97.06112	02/05/19	1400	Absent	--	Absent
L-12	27.85090	-97.06284	02/04/19	1325	Absent	--	Absent
L-13	27.84874	-97.06274	02/05/19	1251	Absent	--	Absent
L-14	27.84787	-97.06194	02/05/19	1200	Slight Presense	1 strand of Halodule	Absent
L-15	27.84602	-97.06012	02/06/19	1305	Absent	--	Absent

TABLE 7
VELOCITY MEASUREMENTS
PORT OF CORPUS CHRISTI AUTHORITY
PROJECT TURNPIKE

Sample Point	Date	Start/End Time	Depth (ft. below water surface)	Velocity (m/s)	Direction (°)	Ebb/Flood	GPS Coordinates (Actual)		Section of Project Area
							North	West	
S-1	2/7/2019	1413	5	0.256	102.3	Ebb	27.85055	-97.06259	Tributary Channel To Aransas Pass
S-2	2/7/2019	1417	5	0.736	301.7	Flood	27.84885	-97.06048	Tributary Channel To Aransas Pass
			10	0.493	314.5				
			15	0.518	327.2				
			20	0.372	325.2				
		1418	25	0.581	324.5				
S-3	2/11/2019	837	5	0.321	18.6	Ebb	27.84935	-97.06102	Tributary Channel To Aransas Pass
			10	0.465	14.3				
			15	0.391	26.3				
		838	20	0.330	27.2				
S-4	2/7/2019	1122	5	0.199	338.4	Ebb	27.84402	-97.06834	Corpus Christi Ship Channel
		1123	10	0.265	114.7				
S-5	2/7/2019	1129	5	0.537	62.2	Ebb	27.84397	-97.06768	Corpus Christi Ship Channel
			10	0.414	62.2				
			15	0.385	62.7				
			20	0.384	60.2				
			25	0.483	66.9				
			30	0.455	46.5				
		1130	35	0.307	74.0				
S-6	2/11/2019	932	5	0.037	33.6	Flood	27.84393	-97.06789	Corpus Christi Ship Channel
			10	0.421	152.5				
			15	0.181	209.1				
		934	20	0.112	246.1				
S-7	2/7/2019	1142	5	0.432	83.8	Ebb	27.84407	-97.06578	Corpus Christi Ship Channel
			10	0.361	68.4				
			15	0.259	58.2				
			20	0.167	91.2				
			25	0.249	82.5				
			30	0.370	56.1				
			35	0.390	52.0				
			40	0.346	60.3				
		1144	45	0.207	86.6				
S-8	2/11/2019	1058	5	0.140	57.1	Flood	27.84409	-97.06571	Corpus Christi Ship Channel
			10	0.128	52.8				
			15	0.057	32.8				
			20	0.095	347.6				
			25	0.077	291.0				
			30	0.097	284.4				
			35	0.077	255.3				
			40	0.143	250.4				
		1101	45	0.157	249.7				
S-9	2/7/2019	1158	5	0.231	233.4	Ebb	27.84475	-97.06200	Corpus Christi Ship Channel
			10	0.261	246.6				
			15	0.166	203.0				
			20	0.246	273.3				
			25	0.071	155.2				
			30	0.048	141.2				
			35	0.140	150.8				
			40	0.272	71.9				
			45	0.454	102.0				
			50	0.284	47.7				
		1202	55	0.421	62.8				
S-10	2/11/2019	944	5	0.149	165.5	Flood	27.84470	-97.06207	Corpus Christi Ship Channel
			10	0.299	173.0				
			15	0.147	193.4				
			20	0.172	170.2				
			25	0.203	161.3				
			30	0.158	185.1				
			35	0.158	208.2				
			40	0.115	217.7				
			45	0.139	258.2				
			50	0.106	240.4				
		948	55	0.118	254.4				
S-11	2/11/2019	850	5	0.151	130.0	Ebb	27.84791	-97.05933	Tributary Channel To Aransas Pass
			10	0.117	14.3				
			15	0.196	17.2				
			20	0.126	34.1				
			25	0.066	17.6				
		852	30	0.126	351.2				
S-12	2/11/2019	1039	5	0.041	221.3	Flood	27.84794	-97.05929	Tributary Channel To Aransas Pass
			10	0.110	333.0				
			15	0.106	358.1				
			20	0.187	9.9				
		1041	25	0.123	16.2				
S-13	2/11/2019	911	5	0.128	352.6	Flood	27.84554	-97.05748	Turning Basin
			10	0.260	26.6				
			15	0.298	40.9				
			20	0.267	32.6				
			25	0.108	25.7				
			30	0.163	145.4				
			35	0.132	234.0				
			40	0.158	281.4				
		914	45	0.217	9.5				

TABLE 7
VELOCITY MEASUREMENTS
PORT OF CORPUS CHRISTI AUTHORITY
PROJECT TURNPIKE

Sample Point	Date	Start/End Time	Depth (ft. below water surface)	Velocity (m/s)	Direction (°)	Ebb/Flood	GPS Coordinates (Actual)		Section of Project Area
							North	West	
S-14	2/11/2019	1956	5	0.110	128.1	Ebb	27.84550	-97.05750	Turning Basin
			10	0.080	28.9				
			15	0.070	22.2				
			20	0.277	18.4				
			25	0.072	14.5				
			30	0.360	22.9				
			35	0.049	61.4				
			40	0.103	42.5				
		1959	45	0.164	10.0				
S-15	2/11/2019	956	5	0.050	214.4	Flood	27.84837	-97.06187	Tributary Channel To Aransas Pass
			10	0.127	234.9				
			15	0.123	223.1				
		957	20	0.169	223.3				
S-16	2/11/2019	1949	5	0.332	345.8	Ebb	27.84826	-97.06189	Tributary Channel To Aransas Pass
			10	0.087	19.1				
			15	0.055	71.7				
		1951	20	0.050	68.6				
S-17	2/11/2019	1008	5	0.173	284.9	Flood	27.84523	-97.05539	Turning Basin
		1009	10	0.070	304.8				
S-18	2/11/2019	2003	5	0.085	181.6	Ebb	27.84516	-97.05539	Turning Basin
			10	0.155	57.6				
		2004	15	0.288	63.8				
S-19	2/11/2019	1018	5	0.131	357.7	Flood	27.84271	-97.05746	Turning Basin
			10	0.076	354.8				
			15	0.105	339.0				
			20	0.108	318.9				
			25	0.074	354.4				
			30	0.102	340.1				
			35	0.196	290.9				
			40	0.134	313.8				
			45	0.207	299.9				
			50	0.216	299.6				
		1022	55	0.114	260.8				
S-20	2/11/2019	2016	5	0.113	281.4	Ebb	27.84254	-97.05746	Turning Basin
			10	0.384	49.5				
			15	0.540	52.8				
			20	0.365	47.8				
			25	0.275	51.0				
			30	0.421	50.1				
			35	0.245	26.8				
			40	0.195	21.4				
		2018	45	0.151	36.5				
S-21	2/11/2019	1026	5	0.082	246.1	Flood	27.84367	-97.05992	Turning Basin
			10	0.050	248.0				
			15	0.141	270.4				
			20	0.152	231.5				
			25	0.155	226.7				
			30	0.057	211.3				
			35	0.127	192.8				
			40	0.236	346.7				
			45	0.182	349.4				
			50	0.158	14.5				
		1031	55	0.039	58.8				
S-22	2/11/2019	2022	5	0.667	77.7	Ebb	27.84308	-97.06057	Turning Basin
			10	0.590	70.7				
			15	0.677	59.3				
			20	0.637	59.9				
			25	0.439	56.6				
			30	0.446	69.2				
			35	0.514	74.0				
			40	0.465	46.0				
		2024	45	0.289	35.7				
S-23	2/11/2019	1047	5	0.456	10.9	Flood	27.84710	-97.05650	Turning Basin
		1047	10	0.367	21.2				
S-24	2/11/2019	2009	5	0.065	140.3	Ebb	27.84707	-97.05651	Turning Basin
		2010	10	0.226	79.3				

ATTACHMENTS

ATTACHMENT 1

PHOTOGRAPHS

PHOTO 1:

Wood personnel calibrating water quality meter.

PHOTO 2:

Wood preparing saline solution used to relax benthic invertebrates prior to fixation and preservation.

PHOTO 3:

Naismith personnel prepare petite ponar for deployment. Wood personnel investigates ponar grab for evidence of seagrass.

PHOTO 4:

Wood personnel sieve material collected by a petite ponar grab for benthic invertebrates.

PHOTO 5:

Collected materials after sieving.

PHOTO 6:

Wood personnel use water bottle to collect invertebrate samples from a sifter.

PHOTO 7:

Placing sediment collected using petite ponar into sample containers for laboratory testing.

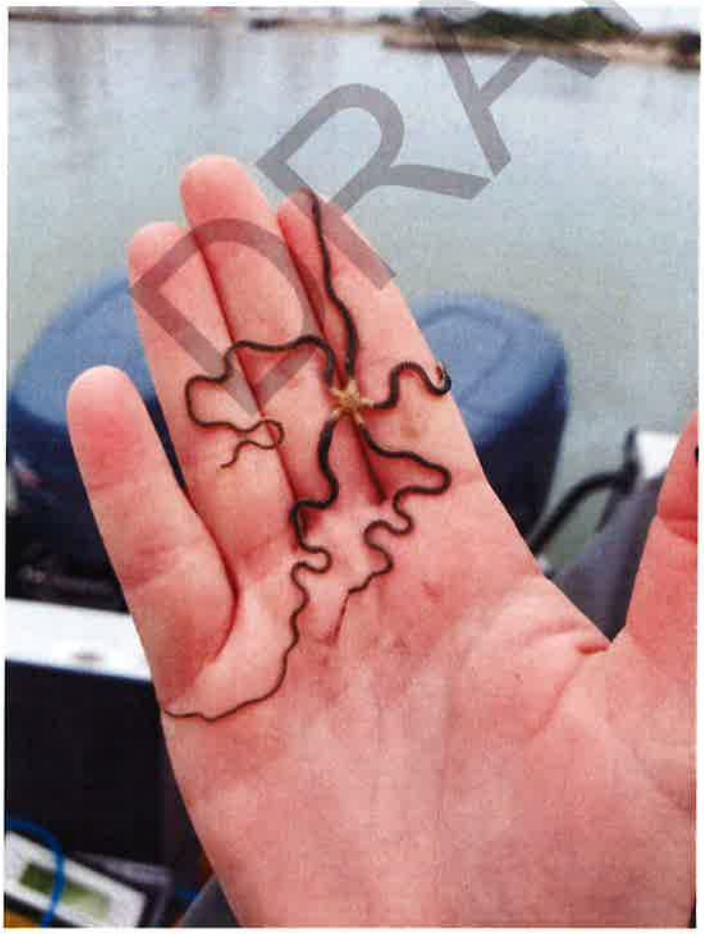


PHOTO 8:

Brittle star (Ophiuroidea sp.) species caught in a petite ponar grab.

PHOTO 9:

Bay Anchovy (*Anchoa mitchilli*) caught in a petite ponar grab.

PHOTO 10:

Luidia clathrata caught during a petite ponar grab.

PHOTO 11:

Wood and Naismith personnel deploy plankton net.

PHOTO 12:

Wood observes and maintains plankton net.

PHOTO 13:

Naismith personnel maintaining stability of plankton net while in water.

PHOTO 14:

Plankton net being retrieved.

PHOTO 15:

Wood personnel rinsing the net to get all organisms down to the sample collection container at the cod end.

PHOTO 16:

Wood personnel use a fine mesh sieve to concentrate plankton samples prior to transferring to sample containers.

PHOTO 17:

Plankton sample collection container.

PHOTO 18:

Wood personnel use a 10% formalin solution to fix all benthic invertebrate samples.

PHOTO 19:

Wood supporting the Valeport 106 Water Velocity Meter.

PHOTO 20:

Valeport 106 Water Velocity Meter display screen.

PHOTO 21:

Wood and Naismith personnel preparing to deploy the Valeport 106 Water Velocity Meter.

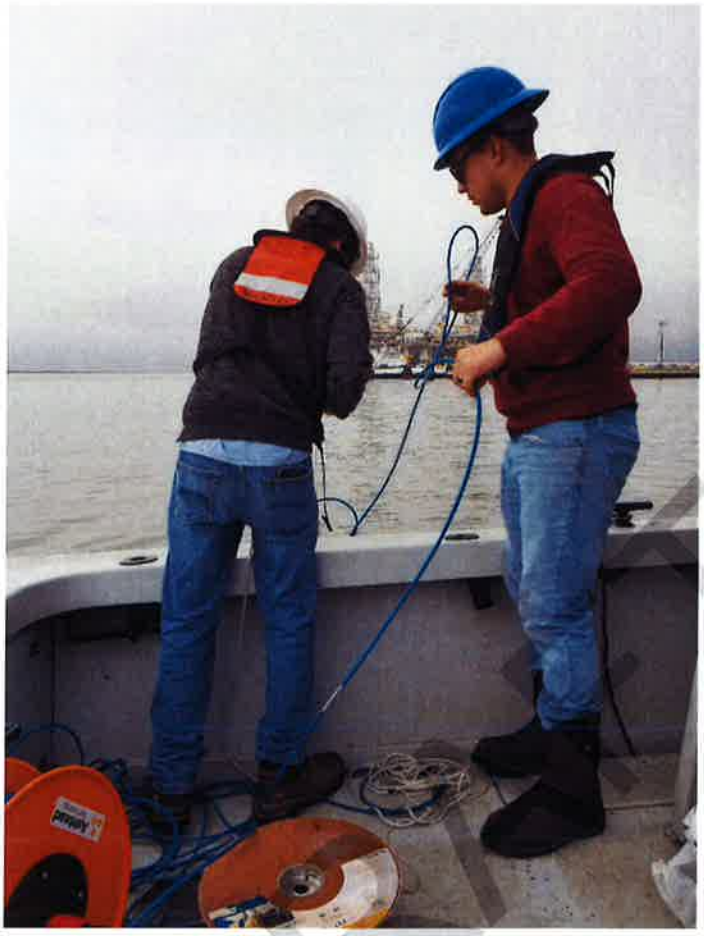


PHOTO 22:

Wood and Naismith personnel deploying the Valeport 106 Water Velocity Meter.

ATTACHMENT 2

DATASHEETS

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: AB + SM

SAMPLE LOCATION: Ship Bell
DATE: 2-7-19
GPS COORDINATES: 27.84407
(ACTUAL) -97.06578

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1142	5			0.432	~~0.046~~	~~89.3~~ 83.8	ebb	
	10			0.361	~~0.489~~	~~63.7~~ 68.4		
	15				0.259	58.2		
	20				0.167	91.2		
	25				0.249	82.5		
	30				0.370	56.1		
	35				0.390	52.0		
	40				0.346	60.3		
1144	45				0.207	86.6	↓	

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: AB & SM

SAMPLE LOCATION: Ship Berth (L2->L3)
DATE: 2/11/2019
GPS COORDINATES: ~~27.44.45cm~~ 27.84409
(ACTUAL) -97.06571

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1058	5				0.140	57.1	Flood	
	10				0.138	52.8	↑	
	15				0.057	32.8		
	20				0.095	347.6		
	25				0.077	291.0		
	30				0.097	254.4		
	35				0.077	255.3		
	40				0.143	250.4		
1101	45				0.157	249.7	↓	

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: DBS & SM

SAMPLE LOCATION: Ship Berth 1A
DATE: 2/11/2019
GPS COORDINATES: (ACTUAL) 27.84837, -97.06187

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
0956	5				0.050	214.4	Flood	
	10				0.127	234.9	1	
	15				0.123	223.1		
0957	20				0.169	223.3		

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: BB & SM

SAMPLE LOCATION: Ship Berth 1A
DATE: 2/11/2019
GPS COORDINATES: 27.84826
(ACTUAL) -97.06189

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1949	5				.332	345.8	EBB	
	10				.087	19.1		
	15				.055	71.7		
1951	20				.050	68.6		

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: AB + SM

SAMPLE LOCATION: Intake & Berth 1B Shallow
DATE: 2-7-19
GPS COORDINATES: 27.84402
(ACTUAL) -97.06834 ~~-97.06102~~ SCM

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1122	5				0.199	338.4	ebb	
1123	10				0.265	114.7	↓	

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: AB + SM

SAMPLE LOCATION: Intake & Berth 1B - Deep
DATE: ~~2-11-19~~ SCM 2-7-19
GPS COORDINATES: 27.84397
(ACTUAL) -97.06768

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1129	5				0.537	62.2	ebb	
	10				0.414	62.2	↓	
	15				0.385	62.7	↓	
	20				0.384	60.2	↓	
	25				0.483	66.9	↓	
1130	30				0.455	46.5	↓	
1130	35				0.307	74.0	↓	

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: AMB & SM

SAMPLE LOCATION: Intake & Berth 1B
DATE: 2/11/2019
GPS COORDINATES: 27.84393
(ACTUAL) -97.06789

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
0932	5				0.037	33.6	Flood	
	10				0.421	152.5		
	15				0.181	209.1		
	20				0.112	246.1		
0934								

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: AB + SM

SAMPLE LOCATION: Ship Berth 1C
DATE: 2-7-19
GPS COORDINATES: 27.84475
(ACTUAL) -97.06200

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1158	5				0.231	233.4	ebb	Likely in slack tide
	10				0.261	246.6		
	15				0.~~0~~166	203.0		
	20				0.246	273.3		
	25				0.071	155.2		
	30				0.048	141.2		
	35			0.140	~~0.~~	150.8		
	40				0.272	71.9		
	45				0.454	102.0		
	50				0.284	47.7		
1207	55				0.421	62.8		

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: AB & SM

SAMPLE LOCATION: Ship Berth 1C
DATE: 2/11/2019
GPS COORDINATES: 27.84470
(ACTUAL) -97.06207

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
0944	5				0.149	165.5	Flood	
	10				0.299	173.0		
	15				0.147	193.4		
	20				0.172	170.2		
	25				0.203	161.3		
	30				0.158	185.1		
	35				0.158	208.2		
	40				0.115	217.7		
	45				0.139	258.2		
	50				0.106	240.4		
0948	55				0.118	254.4		

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6708180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: DB + SM

SAMPLE LOCATION: LS (original)
DATE: 2/6/2019
GPS COORDINATES: 27.84367
(ACTUAL) -97.05992

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1026	5				0.082	246.1	Flood	
	10				0.050	248.0		
	15				0.141	270.4		
	20				0.152	231.5		
	25				0.155	226.7		
	30				0.057	211.3		
	35				0.127	192.8		
	40				0.236	346.7		
	45				0.182	349.4		
	50				0.158	14.5		
1031	55				0.039	58.8		

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: RB & SM

SAMPLE LOCATION: L6
DATE: 7/11/2019
GPS COORDINATES: 27.84254
(ACTUAL) -97.05746

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
2016	5				.113	281.4	EBB	
	10				.384	49.5		
	15				.540	52.8		
	20				.365	47.8		
	25				.275	51.0		
	30				.421	50.1		
	35				.245	26.8		
	40				.195	21.4		
2018	45				.151	36.5		
				L5				GPS Coordinates (Actual):
2022	5				.667	77.7	EBB	27.84308
SCM	10				.590	70.7		-97.06057
	15				.677	59.3		
	20				.637	59.9		
	25				.439	56.6		
	30				.446	69.2		
	35				.514	74.0		
	40				.465	46.0		
2024	45				.289	35.7		

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: AB & SM

SAMPLE LOCATION: L6 (original)
DATE: 2/11/2019
GPS COORDINATES: 27.842771
(ACTUAL) -97.05746

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1018	5				0.131	357.7	Flood	
	10				0.076	354.8		
	15				0.105	339.0		
	20				0.108	318.9		
	25				0.074	354.4		
	30				0.102	340.1		
	35				0.196	290.9		
	40				0.139	313.8		
	45				0.207	299.9		
	50				0.216	299.6		
1022	55				0.114	260.8		

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: ~~MB~~ ESM

SAMPLE LOCATION: Turning Basin 2 ~~TB2 (LL4)~~ SCM
DATE: 2/11/2019
GPS COORDINATES (ACTUAL): 27.84516, -97.05539

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature ~~(°C)~~	Salinity ~~(ppt)~~	Dissolved Oxygen ~~(ml/L)~~	Velocity (m/s)	Direction	Ebb/Flow	Comments
2003	5				0.085	181.6	EBB	
	10				0.155	57.6	↑	
2004	15				0.288	63.8	↓	

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

Turning Basin 2

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: AB & S.M

SAMPLE LOCATION: ~~L7 (TB2)~~ SM
DATE: 2/11/2019
GPS COORDINATES: 27.84523
(ACTUAL) -97.05539

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1008	5				0.173	284.9	Flood	
1009	10				0.070	304.8	1	

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: BBTSM

SAMPLE LOCATION: L8
DATE: 2/11/2019
GPS COORDINATES: 27.84707
(ACTUAL) -97.05651

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
2009	5				.065	140.3	EBB	
2010	10				.226	99.3	↓	

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: AB & SM

SAMPLE LOCATION: AB C08
DATE: 7/11/2019
GPS COORDINATES: 27.84710
(ACTUAL) -97.05650

VARIANCE TIME:
MLLW VARIANCE (ft.)[a] +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1047	5				0.456	10.9	Flood	
1047	10				0.367	21.7	1	
1								

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: AB & SM

SAMPLE LOCATION: Turning Basin 1 ~~VQ LL-9~~ SCM
DATE: 2/13/2019
GPS COORDINATES: 27.84554
(ACTUAL) -97.05748

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flood	Comments
0911	5				0.128	352	Flood	
	10				0.260	26.6		
	15			0.298		40.9		
	20				0.267	32.6		
	25			0.108		25.7		
	30				0.163	145.4		
	35				0.132	234.0		
	40				0.158	281.4		
0914	45				0.217	9.5		

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: AB & SM

SAMPLE LOCATION: Turning Basin 1 ~~FB1 (L9)~~
DATE: 2/11/2019
GPS COORDINATES: 27.84550
(ACTUAL) -97.05750

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1956	5				.110	128.1	EBB	
	10				.080	28.9		
	15				.070	22.2		
	20				.277	18.4		
	25				.072	14.5		
	30				.360	22.9		
	35				.049	61.4		
	40				.103	42.5		
1959	45				.164	10.0		

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: BB & SM

SAMPLE LOCATION: L40
DATE: 2/11/2019
GPS COORDINATES: 27.84794
(ACTUAL) -97.05929

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1039	5				0.041	221.3	Flood	
	10				0.110	333.0		
	15				0.106	358.1		
	20				0.187	9.9		
1041	25				0.173	16.2		

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: ABD JSM

SAMPLE LOCATION: ~~V10 (L-10)~~ L-10 SCM
DATE: 2/11/2019
GPS COORDINATES: 27.84791
(ACTUAL) -97.05933

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
0850	5				0.151	130.0	EBB	
~~0852~~ ABD	10				0.117	14.3	|	
	15				0.196	17.2	|	
	20				0.126	34.1	|	
	25				0.066	17.6	|	
0858	30				0.126	351.2	_	

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: AB + SM

SAMPLE LOCATION: (L-12) V-12 Shallow
DATE: 2-7-19
GPS COORDINATES: 27.85055
(ACTUAL) -97.06259

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1413	5				0.256	102.3	~~Flood~~ EBB	

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

(L-12)

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: AB + SM

SAMPLE LOCATION: V12 Deep
DATE: 2-7-19
GPS COORDINATES: 27.84885
(ACTUAL) -97.06048

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1417	5				0.736	301.7	Flood	
	10				0.493	314.5		
	15				0.518	327.2		
	20				0.372	325.2		
1418	25				0.581	324.5		

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: AB + SM

SAMPLE LOCATION: V12 (L-12)
DATE: 2/11/2019
GPS COORDINATES: 27.84935
(ACTUAL) -97.06102

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
0837	5				0.321	18.6	Ebb	
	10				0.465	14.3	↓	
	15				0.391	26.3		
0838	20				0.330	27.2		

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: SCM + CAT

SAMPLE LOCATION: L-1
DATE: ~~2-14-19~~ 2-4-19
GPS COORDINATES: 27.84432
(ACTUAL) -97.06974

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
~~1110~~		~~15.72~~	~~4.99~~	~~8.64~~ SCM				SCM
1118	2.80	15.74	27.00	96.34				
1120	2.80	15.76	27.01 SCM	83.38				
1122	2.80	15.74	27.00	81.03				
				DO Readings invalid, recalibrated YSI				
				and went back to L-1 to retake readings				
1610	2.80	16.49	24.01	4.43				
1612	2.80	16.59	23.67	4.39				
1614	2.80	16.62	23.81	~~4.92~~ SCM 4.92				

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: SCM + CAT

SAMPLE LOCATION: L-2
DATE: 2-5-19
GPS COORDINATES: 27.84454
(ACTUAL) -97.06691

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (mg/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1000	5.0	15.68	21.29	7.51				
1002	5	15.67	21.28	6.27				
1003	10	15.64	21.29	7.73				
1004	10	15.64	21.28	7.79				
1006	15	15.63	21.28	7.69				
1007	15	15.68	21.29	7.68				
1009	20	15.77	21.34	7.33				
1010	20	15.81	21.36	7.65				

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: SCM + CAT

SAMPLE LOCATION: L-3
DATE: 2-5-19
GPS COORDINATES: 27.84455
(ACTUAL) -97.06724

VARIANCE TIME:
MLLW VARIANCE (ft.)[a] +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1044	5	16.46	20.11	6.06				
1045	5	16.41	19.96	5.78				
1047	10	16.05	21.44	6.22				
1048	10	16.03	21.41	6.26				

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: SCM + CAT

SAMPLE LOCATION: L-4
DATE: 2-5-19
GPS COORDINATES: 27.84496
(ACTUAL) SCM -97.06271

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1457	5	16.91	17.21	5.80				
1458	5	16.94	17.02	5.78				
1500	10	16.72	18.04	6.13				
1501	10	16.71	18.02	~~7.17~~ 5.73				
1503	15	16.68	18.41	5.72 SCM				
1504	15	16.69	18.28	5.72				
1506	20	16.63	~~18.~~ SCM 19.13	5.70				
1507	20	16.61	19.08	SCM 4.65				
1509	25	16.30	21.55	4.23				
1510	25	16.29	21.59	4.61				
	~~3~~ SCM							
	3 SCM							

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: SCM + CAT

SAMPLE LOCATION: L-5
DATE: 2-5-19
GPS COORDINATES: 27.84707
(ACTUAL) -97.05827

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1602	5	16.58	18.20	6.27				
1603	5	16.47	18.38	5.92				
1605	10	16.24	20.98	5.89				
1606	10	16.11	20.74	~~4.44~~ 5.87 SCM 5.84				
1608	15	16.15	21.05					
1609	15	16.04	20.98	5.86				
1611	20	16.12	21.12	6.16				
1612	20	16.09	21.10	6.20				

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: SCM + CAT

SAMPLE LOCATION: L-6
DATE: 2-6-19
GPS COORDINATES: 27.844478
(ACTUAL) -97.05560

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1541	5	16.88	16.21	5.85				
1542	5	16.87	16.22	6.20				
1544	10	16.83	16.48	5.84				
1545	10	16.82	16.42	5.89				
1547 Bottom	15	16.82	16.77	5.81				
1548	15	16.81	16.80	6.19				
1550	20	16.76	17.45	5.82				
1551	20	16.76	17.41	5.83				
1553 Bottom	25	16.75	17.60	6.17				
1554	25	16.75	17.51	5.95				
1556	30	16.74	17.67	5.85				
1557	30	16.76	17.45	5.82				

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: SCM+CAT

SAMPLE LOCATION: L-7
DATE: 2-4-19
GPS COORDINATES: 27.84531
(ACTUAL) -97.05544

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1512	5	16.23	21.52	4.45				
1514	5	16.05	22.48	4.29				
1515 SCM	10	15.90	24.17	4.62				
1518 SCM	10	15.91	24.67	4.25				
1518 SCM	15	15.86	25.02	4.25				
1520 SCM	15	15.87	25.07	4.57				

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6708180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: SCM + CAT

SAMPLE LOCATION: L-8
DATE: 2-4-19
GPS COORDINATES: 27.84708
(ACTUAL) -97.05653

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1420	5	16.02	20.40	5.85				
1422	5	16.01	20.63 SCM	6.16 SCM				
1424	10	15.95	22.50 SCM	6.10				
1426	10	15.94	21.99	6.15				
1428	15	15.97	24.69	6.06				
1430	15	15.96	23.25	6.08 SCM				

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6708180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: SCM + CAT

SAMPLE LOCATION: L-9
DATE: 8-6-19
GPS COORDINATES: 27.84550
(ACTUAL) -97.05749

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1440	5	16.84	15.33	6.09				
1441	5	16.76	15.52	6.31				
1443	10	16.75	16.00	5.94				
1444	10	16.76	16.25	5.96				
1446	15	~~17.~~ 16.77	17.34	6.21				
1447	15	16.71	17.42	6.19				
1449	20	16.78	17.26	5.89				
1450	20	16.78	17.57	6.17				
1452	25	16.86	17.69	6.15				
1453	25	16.86	17.68	6.01				
1455	30	16.82	17.73	5.72				
1456	30	16.76	17.92	6.19				
1458	35	16.73	17.95	5.93				
1459	35	16.73	17.95	5.90				
1501	40	16.72	18.00	6.19				
1502	40	16.72	17.96	5.93				
~~1504~~	~~45~~	SCM						New Lead Line = 44.9'
~~1505~~	~~45~~	SCM						No need for 45' reading

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: SCM+CAT

SAMPLE LOCATION: L-10
DATE: 2-6-19
GPS COORDINATES: 27.84793
(ACTUAL) -97.05938

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1350	5	16.86	15.38	6.09				
1351	5	16.91	15.37	6.02				
1353	10	16.88	15.36	6.29				
1354	10	16.90	15.32	6.06				
1356	15	16.82	15.31	6.01				
1357	15	16.81	15.33	5.98				
1359	20	16.79	15.46	6.23				
1400	20	16.79	15.46	6.31				
1402	25	16.81	16.30	6.21				
1403	25	16.77	16.46	6.06				
1405	30	16.68	16.24	5.94				
1406	30	16.68	17.29	5.84				

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: SCM + CAT

SAMPLE LOCATION: L-11
DATE: 2-5-19
GPS COORDINATES: 27.84906
(ACTUAL) -97.0612

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1346	5	~~S 25.72~~ 16.17	15.71	6.23				
1347	5	~~S 25.80~~ 16.13	15.78	6.21				
1349	10	~~S 26.2~~ 16.59	16.17	6.17				
1350	10	16.62	16.17	5.78				
1352	15	16.73	16.23	6.20				
1353	15	16.72	16.22	6.11				
1355	20	16.64	17.01	5.89				
1356	20	17.06	17.59	5.62				
1358	25	16.12	18.91	5.65				
1359	25	16.12	19.19	5.68				

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: SCM + CAT

SAMPLE LOCATION: L-12
DATE: 2/4/19
GPS COORDINATES: 27.25090
(ACTUAL) -97.06224

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1346	5.0	16.33	20.14	4.66				
1348	5.0	16.30	20.21	4.22				
1350	5.0	16.26	20.32	4.64				

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: SCM + CAT

SAMPLE LOCATION: L-13
DATE: 2-5-19
GPS COORDINATES: 27.84874
(ACTUAL) -97.06274

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
SCM								
1220	5	16.98	16.46	6.11				
1221 SCM 1222	5	17.02	16.51	6.12				
1223 SCM	10	17.59	SCM 17.62	7.00				
1224 SCM	10	17.62	17.67	7.01				
1226 SCM	15	17.78	17.91	6.97				
1227 SCM	15	17.73	17.84	6.99				
1229	20	17.80	17.95	7.29				
1230 SCM	20	17.78	17.92	6.99				
1231 SCM	25	17.82	17.99	6.95				
1232 SCM	25	17.82	17.97	7.09				

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: SCM + CAT

SAMPLE LOCATION: L-14
DATE: 2-5-19
GPS COORDINATES: 27.84787
(ACTUAL) -97.06194

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1140	5	16.92	16.71	SCM 6.26				
1141	5	16.92	16.73	6.99				
1143	10	16.92	SCM 16.72	6.20				
1144	10	16.92	16.73	6.18				
1146	15	16.91	16.71	6.18				
1147	15	17.19	17.18	SCM 6.79				
1149	SCM 20	SCM 17.72	SCM 18.01	7.36				
1150	20	17.75	18.04	7.05				
1152	25	17.75	18.06	7.38				
1153	25	17.75	18.06	7.04				

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

WATER SAMPLING PARAMETERS

wood.

PROJECT NUMBER: 6703180051
CLIENT: Port of Corpus Christi Authority
SITE LOCATION: Project Turnpike
SCIENTIST: SCM+CAT

SAMPLE LOCATION: L-15
DATE: 2-6-19
GPS COORDINATES: 27.84602
(ACTUAL) -97.06012

VARIANCE TIME:
MLLW VARIANCE (ft.)(a) +/-
DEPTH TO SEDIMENT (ft.)
SEDIMENT ELEV. (MLLW) (ft.)

Time	Depth (ft.)	Temperature (°C)	Salinity (ppt)	Dissolved Oxygen (ml/L)	Velocity (m/s)	Direction	Ebb/Flow	Comments
1245	5	17.88	15.68	~~8.52~~ 6.88				
1246	5	17.62	15.71	7.30				
1248	10	17.52	15.79	6.85				
1249	10	17.34	15.79	6.83				
1251	15	17.11	16.01	6.90				
1252	15	17.04	16.00	6.89				
1254	20	16.84	16.23	6.90				
1255	20	16.83	16.57	6.94				
1257	25	16.74	16.70	6.06				
1258	25	16.70	16.69	6.56				
1300	30	16.66	17.20	6.44				
1321 ~~1301~~ SCM	30	16.66	17.21	6.15				20 minutes lost due to YSI Malfunction
1323 ~~1303~~ SCM	35	16.63	17.45	6.29				
1324 ~~1304~~ SCM	35	16.63	17.63	6.28				
1326 ~~1306~~ SCM	40	16.62	17.65	6.32				
1327 ~~1307~~ SCM	40	16.60	17.78	6.01				
1329 ~~1309~~ SCM	45	16.61	18.04	6.30				
1330 ~~1310~~ SCM	45	16.60	18.04	6.30				
1332 ~~1312~~ SCM	50	16.62	18.07	6.44				
1333 ~~1313~~ SCM	50	16.62	18.06	6.19				

(a) MLLW variance taken from NOAA (National Oceanic and Atmospheric Administration) Tides and Currents; Port Aransas, TX, Station ID: 8775237

FIELD INSTRUMENT CALIBRATION SHEET

wood.

Project Name: Project Turnpike

Project Number: 6703180051.0003

Date: 2-4-19

Equipment Type: Water Quality Meter

Manufacturer: ~~SCM Horiba~~ YSI

Model Number: ~~SCM 33-52~~ 6920

Serial Number: 07F100587

Calibration (as necessary, minimum twice per day):

Calibration #1	pH	Cond.	Turb.	DO	ORP	Time: 0825
Calibration Standard:	~~4.0~~	~~4.49~~ 1.413	~~0.0~~	–	~~200-300~~	
Instrument Reading:	/	1.415	/	–	/	

Calibration (as necessary, minimum twice per day):

Calibration #2	pH	Cond.	Turb.	DO	ORP	Time:
Calibration Standard:	4.0	4.49	0.0	–	200-300	
Instrument Reading:						

Calibration (as necessary, minimum twice per day):

Calibration #3	pH	Cond.	Turb.	DO	ORP	Time:
Calibration Standard:	4.0	4.49	0.0	–	200-300	
Instrument Reading:						

Calibration (as necessary, minimum twice per day):

Calibration #4	pH	Cond.	Turb.	DO	ORP	Time:
Calibration Standard:	4.0	4.49	0.0	–	200-300	
Instrument Reading:						

Date of Last Calibration: —

Date(s) Instrument Used: —

Name of person(s) who calibrated Instruments: Samuel C. Macan

Calibration Standards Used:

(1) 1.413 mS/cm SC Conductance Standard

(2)

(3)

(4)

Source of Calibration Standards: Aqua Phoenix ~~Solutions~~ SCM Scientific (Pine)

Miscellaneous Comments: —

Calibrated by: Samuel C. Macan

FIELD INSTRUMENT CALIBRATION SHEET

wood.

Project Name: Project Turnpike

Project Number: 6703180051.0003

Date: 2-5-19

Equipment Type: Water Quality Meter

Manufacturer: ~~Horiba~~ YSI

Model Number: ~~U-52~~ 6920

Serial Number: 97F100587

Calibration (as necessary, minimum twice per day):

Calibration #1	~~pH~~	Cond.	~~Turb.~~	DO	~~ORP~~
Calibration Standard:	~~4.0~~	~~4.49~~ 1.413	~~0.0~~	--	200-300
Instrument Reading:		1.399			

Time: 0755

Calibration (as necessary, minimum twice per day):

Calibration #2	pH	Cond.	Turb.	DO	ORP
Calibration Standard:	4.0	4.49	0.0	--	200-300
Instrument Reading:					

Time: _____

Calibration (as necessary, minimum twice per day):

Calibration #3	pH	Cond.	Turb.	DO	ORP
Calibration Standard:	4.0	4.49	0.0	--	200-300
Instrument Reading:					

Time: _____

Calibration (as necessary, minimum twice per day):

Calibration #4	pH	Cond.	Turb.	DO	ORP
Calibration Standard:	4.0	4.49	0.0	--	200-300
Instrument Reading:					

Time: _____

Date of Last Calibration: 2-4-18

Date(s) Instrument Used: 2-5-19

Name of person(s) who calibrated Instruments: Samuel C. Mecan

Calibration Standards Used:

(1) 1.413 mS/cm Sp. Conductance Standard

(2) _____

(3) _____

(4) _____

Source of Calibration Standards: Aquaphanix Scientific (Pine)

Miscellaneous Comments:

Calibrated by: SCM Samuel C. Mecan

FIELD INSTRUMENT CALIBRATION SHEET

wood.

Project Name: Project Turnpike

Project Number: 6703180051.003

Date: 2-6-19

Equipment Type: Water Quality Meter

Manufacturer: ~~Horiba~~ YSI

Model Number: ~~U-52~~ 6920

Serial Number: 91F0883

Calibration (as necessary, minimum twice per day):

Calibration #1	pH	Cond. mS/cm	Turb.	DO	ORP
Calibration Standard:	~~4.0~~	~~4.49~~ 1.413	~~0.0~~	--	~~200-300~~
Instrument Reading:	✓	1.411	✓	3.45	

Time: 0755

Calibration (as necessary, minimum twice per day):

Calibration #2	pH	Cond.	Turb.	DO	ORP
Calibration Standard:	4.0	4.49	0.0	--	200-300
Instrument Reading:					

Time: _____

Calibration (as necessary, minimum twice per day):

Calibration #3	pH	Cond.	Turb.	DO	ORP
Calibration Standard:	4.0	4.49	0.0	--	200-300
Instrument Reading:					

Time: _____

Calibration (as necessary, minimum twice per day):

Calibration #4	pH	Cond.	Turb.	DO	ORP
Calibration Standard:	4.0	4.49	0.0	--	200-300
Instrument Reading:					

Time: _____

Date of Last Calibration: 2-5-19

Date(s) Instrument Used: 2-6-19

Name of person(s) who calibrated instruments: Samuel C, McCan

Calibration Standards Used:

(1) 1.413 mS/cm Sp. Conductance Standard

(2) _____

(3) _____

(4) _____

Source of Calibration Standards: Aquaphacnix ~~Solutions~~ Scientific (Pine)

Miscellaneous Comments: Serial #: ~~_____~~ Handset changed out for this day, hence the ~~dif~~ different serial #.

Calibrated by: Samuel C McCan

Corpus Christi
Field Form – Plankton Sampling

9,481 counts

Project Information

Sample ID: P-1

Collection Date: 6 Feb 2019

Sampling Method: plankton tow by spec 1574

Collection Time: 1035 am

Client: Port of Corpus Christi

Field Team: Carl Teinert, Jennifer Davenport, Ashley Bergeron, Sam Macon, Naismith Marine

Location: Port Aransas, TX -

Weather: cloudy

Operational Data

Tow location (CIRCLE ONE): SURFACE MIDDLE BOTTOM Other: oblique

Depth (ft): Start 82' End

Depth (m): Start End

Sample Start Time: 9:57 (am) or pm

Sample Stop Time: 10:07 (am) or pm

Start Flow Meter Reading: 1583

Stop Flow Meter Reading: 16447

Effort (seconds): 600 seconds

Waypoint ID: WPT N/A

GPS Location: Longitude Start see boat log N End North

Latitude: see boat log W West

DRAFT

Comments (observations, etc)

Distance (m) = (16447 - 1583) × 26,873 / 999999 = 399.44 m

Speed (cm/s) = 399.44 × 100 / 600 = 66.57 cm/s

Volume (m³) = 3.14159 × .25² × 399.44 = 78.43 m³

Signature: ______ Date: ______ Page ___ of ___

Data form QA'd ______ (Date) by ______ (Initials). Data entered in db ______ (Date) by ______ (Initials). Data entry QA'd ______ (Date) by ______ (Initials).

Corpus Christi
Field Form – Plankton Sampling

Project Information

Sample ID: P-2
Collection Date: 6 Feb 2019
Sampling Method: plankton tow/oblique 1 & 2
Collection Time: 11:22am
Client: Port of Corpus Christi
Field Team: Carl Teiner, Jennifer Davenport, Sam Marcon, Ashley Bagwell, Naismith Martin
Location: Port Aransas, TX
Weather: cloudy

Operational Data

Tow location (CIRCLE ONE): SURFACE MIDDLE BOTTOM Other: oblique

Depth (ft) Start: 41' End: 64'
Depth (m): Start: End:

Sample Start Time: 1054 **am or pm**
Sample Stop Time: 1103 **am or pm**

Start Flow Meter Reading: 17593
Stop Flow Meter Reading: 29317

Effort (seconds): 540
Waypoint ID: WPT N/A

GPS Location: Longitude see boat log **North** **Latitude:** see boat log **West**

Comments (observations, etc)

Distance(m) = (29317 − 17593) × 26,873 / 999,999 = 315.06m

Speed(cm/s) = 315.06 × 100 / 540 = 58.34 cm/s

Volume(m³) = 3.14159 × .25² × 315.06m = 61.86m³

Signature: ______ Date: ______ Page ____ of ____

Data form QA'd ______ by ______ (Date, Initials)
Data entered in db ______ by ______ (Date, Initials)
Data entry QA'd ______ by ______ (Date, Initials)

DRAFT

Corpus Christi, TX Benthic Samples				
Project #:	6703180051		**Samplers:**	Ashley Bernard, Carl Teinert, Sam Moran, Jennifer Davenport
Sample ID	**Sample Date**	**Collection Time**	**P/A Seagrass & Oysters**	**Comments**
L-1	4 Feb 2019	11:38am	Absent	fine sand, little shell hash
L-2	5 Feb 2019	10:15am	Present	- Halodule + [illegible] - fine mud, clay
L-3	5 Feb 2019	10:53am	Absent	Shell hash, sand
L-4	5 Feb 2019	15:18	Absent	Clay, shell hash
L-5	5 Feb 2019	16:12	Absent	Sand
L-6	6 Feb 2019	16:05	Absent	shell hash, Diopatra tubes
L-7	4 Feb 2019	15:20	Absent	fine sand, very small sample
L-8	4 Feb 2019	14:33	Absent	fine sand, very small sample
L-9	6 Feb 2019	15:00	Absent	sand, shell hash
L-10	6 Feb 2019	13:56	Absent	dried Halodule, fine sand, mud
L-11	5 Feb 2019	13:57	Absent	shell hash, fine sand
L-12	4 Feb 2019	13:15	Absent	fine sand, larger shell hash
L-13	5 Feb 2019	12:41	Present - 1 piece of Syringodium	rocks, shell hash, fine sand
L-14	5 Feb 2019	12:00	Absent	mud, shell hash, 1 dead oyster, clay
L-15	6 Feb 2019	12:55	Present - 1 piece of Halodule	mud, fine sand

Thalassia testudinum = turtle grass

Syringodium filiforme = manatee
spaghetti
round
used w/ Thalassia

Ruppia = widgeon

shoal grass
Halodule -
flat, tiny,
skinny

Flowmeter Model General Oceanics, Mechanical Flowmeter, Model #2030R
Rotor Constant 26873

Station ID	Date	Time	Tech(s)	Mesh Size, microns	Opening Diameter, cm	Initial Time	Final Time	Elapsed Time, min	Initial Count, Flowmeter
P-1	2/6/2019	10:35	JSD, CT, SM, AB	333	50	9:57	10:07	0:10	1583
P-2	2/6/2019	11:22	JSD, CT, SM, AB	333	50	10:54	11:03	0:09	17593

Final Count, Flowmeter	Turns	Distance, m	Speed, cm/sec	Volume, cubic meters
16447	14864	399.44	66.57	78.43
29317	11724	315.06	58.34	61.86

ATTACHMENT 3

LABORATORY REPORTS

10450 Stancliff Rd. Suite 210
Houston, TX 77099
T: +1 281 530 5656
F: +1 281 530 5887

February 27, 2019

Carl Teinert
Wood Environment & Infrastructure Solutions
3755 S. Capital of Texas Highway
Ste. 375
Austin, TX 78704

Work Order: **HS19020370**

Laboratory Results for: **PCCA Turnpike 6703180051**

Dear Carl,

ALS Environmental received 14 sample(s) on Feb 07, 2019 for the analysis presented in the following report.

The analytical data provided relates directly to the samples received by ALS Environmental and for only the analyses requested. Results are expressed as "as received" unless otherwise noted.

QC sample results for this data met EPA or laboratory specifications except as noted in the Case Narrative or as noted with qualifiers in the QC batch information. Should this laboratory report need to be reproduced, it should be reproduced in full unless written approval has been obtained by ALS Environmental. Samples will be disposed in 30 days unless storage arrangements are made.

If you have any questions regarding this report, please feel free to call me.

Sincerely,

Generated By: JUMOKE.LAWAL
Dane J. Wacasey

Client: Wood Environment & Infrastructure Solutions
Project: PCCA Turnpike 6703180051
Work Order: HS19020370

SAMPLE SUMMARY

Lab Samp ID	Client Sample ID	Matrix	TagNo	Collection Date	Date Received	Hold
HS19020370-01	L-1	Sediment		04-Feb-2019 11:55	07-Feb-2019 07:30	☐
HS19020370-02	L-2	Sediment		05-Feb-2019 10:15	07-Feb-2019 07:30	☐
HS19020370-03	L-3	Sediment		05-Feb-2019 10:55	07-Feb-2019 07:30	☐
HS19020370-04	L-4	Sediment		05-Feb-2019 15:15	07-Feb-2019 07:30	☐
HS19020370-05	L-5	Sediment		05-Feb-2019 16:20	07-Feb-2019 07:30	☐
HS19020370-06	L-7	Sediment		04-Feb-2019 15:30	07-Feb-2019 07:30	☐
HS19020370-07	L-8	Sediment		04-Feb-2019 14:40	07-Feb-2019 07:30	☐
HS19020370-08	L-9	Sediment		06-Feb-2019 15:05	07-Feb-2019 07:30	☐
HS19020370-09	L-10	Sediment		06-Feb-2019 14:07	07-Feb-2019 07:30	☐
HS19020370-10	L-11	Sediment		05-Feb-2019 14:00	07-Feb-2019 07:30	☐
HS19020370-11	L-12	Sediment		04-Feb-2019 13:25	07-Feb-2019 07:30	☐
HS19020370-12	L-13	Sediment		05-Feb-2019 12:51	07-Feb-2019 07:30	☐
HS19020370-13	L-14	Sediment		05-Feb-2019 12:00	07-Feb-2019 07:30	☐
HS19020370-14	L-15	Sediment		06-Feb-2019 13:05	07-Feb-2019 07:30	☐

Client: Wood Environment & Infrastructure Solutions **CASE NARRATIVE**
Project: PCCA Turnpike 6703180051
Work Order: HS19020370

Work Order Comments

- The analysis for Grain Size was subcontracted to Tolunay-Wong Engineers in Houston, TX. Final report attached.

WetChemistry by Method SW9060

Batch ID: 137969

Sample ID: L-2 (HS19020370-02MS)

- The recovery of the Matrix Spike (MS) and/or Matrix Spike Duplicate (MSD) associated with this analyte was outside of the established control limits. However, the LCS was within control limits. The recovery of the MS/MSD may be due to sample matrix interference. (Total Organic Carbon)

Sample ID: L-2 (HS19020370-02MSD)

- The recovery of the Matrix Spike (MS) and/or Matrix Spike Duplicate (MSD) associated with this analyte was outside of the established control limits. However, the LCS was within control limits. The recovery of the MS/MSD may be due to sample matrix interference. (Total Organic Carbon)

Client:	Wood Environment & Infrastructure Solutions	**ANALYTICAL REPORT**
Project:	PCCA Turnpike 6703180051	WorkOrder:HS19020370
Sample ID:	L-1	Lab ID:HS19020370-01
Collection Date:	04-Feb-2019 11:55	Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
TOTAL ORGANIC CARBON BY SW9060A		**Method:SW9060**			Prep:SW9060 / 21-Feb-2019		Analyst: KMU
Total Organic Carbon	**0.0630**		**0.0600**	**0.0600**	**wt%-dry**	1	23-Feb-2019 10:30
SUBCONTRACT ANALYSIS - GRAIN SIZE		**Method:NA**					Analyst: SUB
Subcontract Analysis	See Attached		0		NA	1	27-Feb-2019 15:39

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Wood Environment & Infrastructure Solutions
Project: PCCA Turnpike 6703180051
Sample ID: L-2
Collection Date: 05-Feb-2019 10:15

ANALYTICAL REPORT
WorkOrder:HS19020370
Lab ID:HS19020370-02
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
TOTAL ORGANIC CARBON BY SW9060A		**Method:SW9060**			Prep:SW9060 / 21-Feb-2019		Analyst: KMU
Total Organic Carbon	**0.475**		**0.0600**	**0.0600**	**wt%-dry**	1	23-Feb-2019 10:30
SUBCONTRACT ANALYSIS - GRAIN SIZE		**Method:NA**					Analyst: SUB
Subcontract Analysis	See Attached		0		NA	1	27-Feb-2019 15:39

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Wood Environment & Infrastructure Solutions
Project: PCCA Turnpike 6703180051
Sample ID: L-3
Collection Date: 05-Feb-2019 10:55

ANALYTICAL REPORT
WorkOrder:HS19020370
Lab ID:HS19020370-03
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
TOTAL ORGANIC CARBON BY SW9060A		**Method:SW9060**			Prep:SW9060 / 21-Feb-2019		Analyst: KMU
Total Organic Carbon	**0.407**		**0.0600**	**0.0600**	**wt%-dry**	1	23-Feb-2019 10:30
SUBCONTRACT ANALYSIS - GRAIN SIZE		**Method:NA**					Analyst: SUB
Subcontract Analysis	See Attached		0		NA	1	27-Feb-2019 15:39

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client:	Wood Environment & Infrastructure Solutions	**ANALYTICAL REPORT**
Project:	PCCA Turnpike 6703180051	WorkOrder:HS19020370
Sample ID:	L-4	Lab ID:HS19020370-04
Collection Date:	05-Feb-2019 15:15	Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
TOTAL ORGANIC CARBON BY SW9060A		**Method:SW9060**			Prep:SW9060 / 21-Feb-2019		Analyst: KMU
Total Organic Carbon	**0.319**		**0.0600**	**0.0600**	**wt%-dry**	1	23-Feb-2019 10:30
SUBCONTRACT ANALYSIS - GRAIN SIZE		**Method:NA**					Analyst: SUB
Subcontract Analysis	See Attached		0		NA	1	27-Feb-2019 15:39

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Wood Environment & Infrastructure Solutions
Project: PCCA Turnpike 6703180051
Sample ID: L-5
Collection Date: 05-Feb-2019 16:20

ANALYTICAL REPORT
WorkOrder:HS19020370
Lab ID:HS19020370-05
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
TOTAL ORGANIC CARBON BY SW9060A		**Method:SW9060**			Prep:SW9060 / 21-Feb-2019		Analyst: KMU
Total Organic Carbon		U	0.0600	0.0600	wt%-dry	1	23-Feb-2019 10:30
SUBCONTRACT ANALYSIS - GRAIN SIZE		**Method:NA**					Analyst: SUB
Subcontract Analysis	See Attached		0		NA	1	27-Feb-2019 15:39

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Wood Environment & Infrastructure Solutions
Project: PCCA Turnpike 6703180051
Sample ID: L-7
Collection Date: 04-Feb-2019 15:30

ANALYTICAL REPORT
WorkOrder:HS19020370
Lab ID:HS19020370-06
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
TOTAL ORGANIC CARBON BY SW9060A		**Method:SW9060**			Prep:SW9060 / 21-Feb-2019		Analyst: KMU
Total Organic Carbon		U	0.0600	0.0600	wt%-dry	1	23-Feb-2019 10:30
SUBCONTRACT ANALYSIS - GRAIN SIZE		**Method:NA**					Analyst: SUB
Subcontract Analysis	See Attached		0		NA	1	27-Feb-2019 15:39

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Wood Environment & Infrastructure Solutions
Project: PCCA Turnpike 6703180051
Sample ID: L-8
Collection Date: 04-Feb-2019 14:40

ANALYTICAL REPORT
WorkOrder:HS19020370
Lab ID:HS19020370-07
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
TOTAL ORGANIC CARBON BY SW9060A		**Method:SW9060**			Prep:SW9060 / 21-Feb-2019		Analyst: KMU
Total Organic Carbon		U	0.0600	0.0600	wt%-dry	1	23-Feb-2019 10:30
SUBCONTRACT ANALYSIS - GRAIN SIZE		**Method:NA**					Analyst: SUB
Subcontract Analysis	See Attached		0		NA	1	27-Feb-2019 15:39

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client:	Wood Environment & Infrastructure Solutions	**ANALYTICAL REPORT**
Project:	PCCA Turnpike 6703180051	WorkOrder:HS19020370
Sample ID:	L-9	Lab ID:HS19020370-08
Collection Date:	06-Feb-2019 15:05	Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
TOTAL ORGANIC CARBON BY SW9060A		**Method:SW9060**			Prep:SW9060 / 21-Feb-2019		Analyst: KMU
Total Organic Carbon		U	0.0600	0.0600	wt%-dry	1	23-Feb-2019 10:30
SUBCONTRACT ANALYSIS - GRAIN SIZE		**Method:NA**					Analyst: SUB
Subcontract Analysis	See Attached		0		NA	1	27-Feb-2019 15:39

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Wood Environment & Infrastructure Solutions
Project: PCCA Turnpike 6703180051
Sample ID: L-10
Collection Date: 06-Feb-2019 14:07

ANALYTICAL REPORT
WorkOrder:HS19020370
Lab ID:HS19020370-09
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
TOTAL ORGANIC CARBON BY SW9060A		**Method:SW9060**			Prep:SW9060 / 21-Feb-2019		Analyst: KMU
Total Organic Carbon	**0.0670**		**0.0600**	**0.0600**	**wt%-dry**	1	23-Feb-2019 10:30
SUBCONTRACT ANALYSIS - GRAIN SIZE		**Method:NA**					Analyst: SUB
Subcontract Analysis	See Attached		0		NA	1	27-Feb-2019 15:39

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client:	Wood Environment & Infrastructure Solutions	**ANALYTICAL REPORT**
Project:	PCCA Turnpike 6703180051	WorkOrder:HS19020370
Sample ID:	L-11	Lab ID:HS19020370-10
Collection Date:	05-Feb-2019 14:00	Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
TOTAL ORGANIC CARBON BY SW9060A		**Method:SW9060**			Prep:SW9060 / 21-Feb-2019		Analyst: KMU
Total Organic Carbon	**0.515**		**0.0600**	**0.0600**	**wt%-dry**	1	23-Feb-2019 10:30
SUBCONTRACT ANALYSIS - GRAIN SIZE		**Method:NA**					Analyst: SUB
Subcontract Analysis	See Attached		0		NA	1	27-Feb-2019 15:39

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client:	Wood Environment & Infrastructure Solutions	**ANALYTICAL REPORT**
Project:	PCCA Turnpike 6703180051	WorkOrder:HS19020370
Sample ID:	L-12	Lab ID:HS19020370-11
Collection Date:	04-Feb-2019 13:25	Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
TOTAL ORGANIC CARBON BY SW9060A		**Method:SW9060**			Prep:SW9060 / 21-Feb-2019		Analyst: KMU
Total Organic Carbon	**0.161**		**0.0600**	**0.0600**	**wt%-dry**	1	23-Feb-2019 10:30
SUBCONTRACT ANALYSIS - GRAIN SIZE		**Method:NA**					Analyst: SUB
Subcontract Analysis	See Attached		0		NA	1	27-Feb-2019 15:39

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Wood Environment & Infrastructure Solutions
Project: PCCA Turnpike 6703180051
Sample ID: L-13
Collection Date: 05-Feb-2019 12:51

ANALYTICAL REPORT
WorkOrder:HS19020370
Lab ID:HS19020370-12
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
TOTAL ORGANIC CARBON BY SW9060A		**Method:SW9060**			Prep:SW9060 / 21-Feb-2019		Analyst: KMU
Total Organic Carbon	**0.494**		**0.0600**	**0.0600**	**wt%-dry**	1	23-Feb-2019 10:30
SUBCONTRACT ANALYSIS - GRAIN SIZE		**Method:NA**					Analyst: SUB
Subcontract Analysis	See Attached		0		NA	1	27-Feb-2019 15:39

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client:	Wood Environment & Infrastructure Solutions	**ANALYTICAL REPORT**
Project:	PCCA Turnpike 6703180051	WorkOrder:HS19020370
Sample ID:	L-14	Lab ID:HS19020370-13
Collection Date:	05-Feb-2019 12:00	Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
TOTAL ORGANIC CARBON BY SW9060A		**Method:SW9060**			Prep:SW9060 / 21-Feb-2019		Analyst: KMU
Total Organic Carbon	**0.264**		**0.0600**	**0.0600**	**wt%-dry**	1	23-Feb-2019 10:30
SUBCONTRACT ANALYSIS - GRAIN SIZE		**Method:NA**					Analyst: SUB
Subcontract Analysis	See Attached		0		NA	1	27-Feb-2019 15:39

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Wood Environment & Infrastructure Solutions
Project: PCCA Turnpike 6703180051
Sample ID: L-15
Collection Date: 06-Feb-2019 13:05

ANALYTICAL REPORT
WorkOrder:HS19020370
Lab ID:HS19020370-14
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
TOTAL ORGANIC CARBON BY SW9060A		**Method:SW9060**			Prep:SW9060 / 21-Feb-2019		Analyst: KMU
Total Organic Carbon		U	0.0600	0.0600	wt%-dry	1	23-Feb-2019 10:30
SUBCONTRACT ANALYSIS - GRAIN SIZE		**Method:NA**					Analyst: SUB
Subcontract Analysis	See Attached		0		NA	1	27-Feb-2019 15:39

Note: See Qualifiers Page for a list of qualifiers and their explanation.

WEIGHT LOG

Client: Wood Environment & Infrastructure Solutions
Project: PCCA Turnpike 6703180051
WorkOrder: HS19020370

Batch ID: 137969 **Method:** TOTAL ORGANIC CARBON BY SW9060A **Prep:** TOC_SOLID_PR

SampID	Container	Sample Wt/Vol	Final Volume	Prep Factor
HS19020370-01	1	0.5	0.5 (mL)	1
HS19020370-02	1	0.5	0.5 (mL)	1
HS19020370-03	1	0.5	0.5 (mL)	1
HS19020370-04	1	0.5	0.5 (mL)	1
HS19020370-05	1	0.5	0.5 (mL)	1
HS19020370-06	1	0.5	0.5 (mL)	1
HS19020370-07	1	0.5	0.5 (mL)	1
HS19020370-08	1	0.5	0.5 (mL)	1
HS19020370-09	1	0.5	0.5 (mL)	1
HS19020370-10	1	0.5	0.5 (mL)	1
HS19020370-11	1	0.5	0.5 (mL)	1
HS19020370-12	1	0.5	0.5 (mL)	1
HS19020370-13	1	0.5	0.5 (mL)	1
HS19020370-14	1	0.5	0.5 (mL)	1

Client: Wood Environment & Infrastructure Solutions
Project: PCCA Turnpike 6703180051
WorkOrder: HS19020370

DATES REPORT

Sample ID	Client Samp ID	Collection Date	TCLP Date	Prep Date	Analysis Date	DF
Batch ID 137969	**Test Name :** TOTAL ORGANIC CARBON BY SW9060A			**Matrix:** Sediment		
HS19020370-01	L-1	04 Feb 2019 11:55		21 Feb 2019 16:20	23 Feb 2019 10:30	1
HS19020370-02	L-2	05 Feb 2019 10:15		21 Feb 2019 16:20	23 Feb 2019 10:30	1
HS19020370-03	L-3	05 Feb 2019 10:55		21 Feb 2019 16:20	23 Feb 2019 10:30	1
HS19020370-04	L-4	05 Feb 2019 15:15		21 Feb 2019 16:20	23 Feb 2019 10:30	1
HS19020370-05	L-5	05 Feb 2019 16:20		21 Feb 2019 16:20	23 Feb 2019 10:30	1
HS19020370-06	L-7	04 Feb 2019 15:30		21 Feb 2019 16:20	23 Feb 2019 10:30	1
HS19020370-07	L-8	04 Feb 2019 14:40		21 Feb 2019 16:20	23 Feb 2019 10:30	1
HS19020370-08	L-9	06 Feb 2019 15:05		21 Feb 2019 16:20	23 Feb 2019 10:30	1
HS19020370-09	L-10	06 Feb 2019 14:07		21 Feb 2019 16:20	23 Feb 2019 10:30	1
HS19020370-10	L-11	05 Feb 2019 14:00		21 Feb 2019 16:20	23 Feb 2019 10:30	1
HS19020370-11	L-12	04 Feb 2019 13:25		21 Feb 2019 16:20	23 Feb 2019 10:30	1
HS19020370-12	L-13	05 Feb 2019 12:51		21 Feb 2019 16:20	23 Feb 2019 10:30	1
HS19020370-13	L-14	05 Feb 2019 12:00		21 Feb 2019 16:20	23 Feb 2019 10:30	1
HS19020370-14	L-15	06 Feb 2019 13:05		21 Feb 2019 16:20	23 Feb 2019 10:30	1
Batch ID R333655	**Test Name :** SUBCONTRACT ANALYSIS - GRAIN SIZE			**Matrix:** Sediment		
HS19020370-01	L-1	04 Feb 2019 11:55			27 Feb 2019 15:39	1
HS19020370-02	L-2	05 Feb 2019 10:15			27 Feb 2019 15:39	1
HS19020370-03	L-3	05 Feb 2019 10:55			27 Feb 2019 15:39	1
HS19020370-04	L-4	05 Feb 2019 15:15			27 Feb 2019 15:39	1
HS19020370-05	L-5	05 Feb 2019 16:20			27 Feb 2019 15:39	1
HS19020370-06	L-7	04 Feb 2019 15:30			27 Feb 2019 15:39	1
HS19020370-07	L-8	04 Feb 2019 14:40			27 Feb 2019 15:39	1
HS19020370-08	L-9	06 Feb 2019 15:05			27 Feb 2019 15:39	1
HS19020370-09	L-10	06 Feb 2019 14:07			27 Feb 2019 15:39	1
HS19020370-10	L-11	05 Feb 2019 14:00			27 Feb 2019 15:39	1
HS19020370-11	L-12	04 Feb 2019 13:25			27 Feb 2019 15:39	1
HS19020370-12	L-13	05 Feb 2019 12:51			27 Feb 2019 15:39	1
HS19020370-13	L-14	05 Feb 2019 12:00			27 Feb 2019 15:39	1
HS19020370-14	L-15	06 Feb 2019 13:05			27 Feb 2019 15:39	1

Client: Wood Environment & Infrastructure Solutions
Project: PCCA Turnpike 6703180051
WorkOrder: HS19020370

QC BATCH REPORT

Batch ID: 137969 **Instrument: TOC_03** **Method: SW9060**

MBLK Sample ID: **MBLK-137969** Units: **wt%-dry** Analysis Date: **23-Feb-2019 10:30**
Client ID: Run ID: **TOC_03_333387** SeqNo: **4961530** PrepDate: **21-Feb-2019** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Total Organic Carbon	U	0.0600								

LCS Sample ID: **LCS-137969** Units: **wt%-dry** Analysis Date: **23-Feb-2019 10:30**
Client ID: Run ID: **TOC_03_333387** SeqNo: **4961529** PrepDate: **21-Feb-2019** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Total Organic Carbon	29	0.0600	30	0	96.6	80 - 120				

MS Sample ID: **HS19020370-02MS** Units: **wt%-dry** Analysis Date: **23-Feb-2019 10:30**
Client ID: **L-2** Run ID: **TOC_03_333387** SeqNo: **4961527** PrepDate: **21-Feb-2019** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Total Organic Carbon	7.866	0.0600	10	0.475	73.9	80 - 120				S

MSD Sample ID: **HS19020370-02MSD** Units: **wt%-dry** Analysis Date: **23-Feb-2019 10:30**
Client ID: **L-2** Run ID: **TOC_03_333387** SeqNo: **4961528** PrepDate: **21-Feb-2019** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Total Organic Carbon	7.523	0.0600	10	0.475	70.5	80 - 120	7.866	4.46	20	S

The following samples were analyzed in this batch:

HS19020370-01	HS19020370-02	HS19020370-03	HS19020370-04
HS19020370-05	HS19020370-06	HS19020370-07	HS19020370-08
HS19020370-09	HS19020370-10	HS19020370-11	HS19020370-12
HS19020370-13	HS19020370-14		

Client:	Wood Environment & Infrastructure Solutions	**QUALIFIERS, ACRONYMS, UNITS**
Project:	PCCA Turnpike 6703180051	
WorkOrder:	**HS19020370**	

Qualifier	Description
*	Value exceeds Regulatory Limit
a	Not accredited
B	Analyte detected in the associated Method Blank above the Reporting Limit
E	Value above quantitation range
H	Analyzed outside of Holding Time
J	Analyte detected below quantitation limit
M	Manually integrated, see raw data for justification
n	Not offered for accreditation
ND	Not Detected at the Reporting Limit
O	Sample amount is > 4 times amount spiked
P	Dual Column results percent difference > 40%
R	RPD above laboratory control limit
S	Spike Recovery outside laboratory control limits
U	Analyzed but not detected above the MDL/SDL

Acronym	Description
DCS	Detectability Check Study
DUP	Method Duplicate
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MBLK	Method Blank
MDL	Method Detection Limit
MQL	Method Quantitation Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PDS	Post Digestion Spike
PQL	Practical Quantitaion Limit
SD	Serial Dilution
SDL	Sample Detection Limit
TRRP	Texas Risk Reduction Program

Unit Reported	Description
Date	

CERTIFICATIONS,ACCREDITATIONS & LICENSES

Agency	Number	Expire Date
Arkansas	88-0356	27-Mar-2019
Texas	T10470231-18-21	30-Apr-2019
North Dakota	R193 2018-2019	30-Apr-2019
Illinois	004438	29-Jun-2019
Louisiana	03087	30-Jun-2019
Dept of Defense	ANAB L2231	20-Dec-2021
Kentucky	123043 - 2018	30-Apr-2019
Kansas	E-10352 2018-2019	31-Jul-2019
Oklahoma	2018-156	31-Aug-2019
North Carolina	624-2019	31-Dec-2019
California	2919, 2018-2019	30-Apr-2019
Maryland	343, 2018-2019	30-Jun-2019

ALS Houston, US Date: 27-Feb-19

Sample Receipt Checklist

Client Name: Wood Austin
Work Order: HS19020370

Date/Time Received: **07-Feb-2019 07:30**
Received by: **DDG**

Checklist completed by: *Raegen Giga* eSignature 7-Feb-2019 Date

Reviewed by: *Dane J. Wacasey* eSignature 8-Feb-2019 Date

Matrices: **Sediment**

Carrier name: **Greyhound**

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
VOA/TX1005/TX1006 Solids in hermetically sealed vials?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	1 Page(s)
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	COC IDs:198653/198652
Samplers name present on COC?	Yes ☐	No ☑	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	
Temperature(s)/Thermometer(s):	0.2c/0.5c - 0.5c/0.8c - 0.3c/0.6c uc/c	IR 25	
Cooler(s)/Kit(s):	4417/23954/43777		
Date/Time sample(s) sent to storage:	02/07/2019 17:46		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	N/A ☑
pH adjusted?	Yes ☐	No ☐	N/A ☑
pH adjusted by:			

Login Notes:

Client Contacted: Date Contacted: Person Contacted:

Contacted By: Regarding:

Comments:

Corrective Action:

Cincinnati, OH +1 513 733 5336
Everett, WA +1 425 356 2600
Fort Collins, CO +1 970 490 1511
Holland, MI +1 616 399 6070
Houston, TX +1 281 530 5656
Middletown, PA +1 717 944 5541
Spring City, PA +1 610 948 4903
Salt Lake City, UT +1 801 266 7700
South Charleston, WV +1 304 356 3168
York, PA +1 717 505 5280

Chain of Custody Form

COC ID: 198653

Customer Information		Project Information		ALS Project Manager:		ALS Work Order #:
Purchase Order	6703180051.0003	Project Name	PCCA Turnpike 6703180051	Parameter/Method Request for Analysis		
Work Order		Project Number	6703180051.0003	A	TOC_S (9060 TOC)	
Company Name	Wood Environment & Infrastructure	Bill To Company	Wood Environment & Infrastructure	B	SUB_GRAINSIZE (ASTM D422 Grain Size (Sub TWE))	
Send Report To	Carl Teinert	Invoice Attn	Carl Teinert	C		
Address	3755 S. Capital of Texas Highway Ste. 375	Address	3755 S. Capital of Texas Highway Ste. 375	D	HS19020370	
City/State/Zip	Austin, TX 78704	City/State/Zip	Austin TX 78704	E	Wood Environment & Infrastructure Solutions	
Phone	(512) 795-0360	Phone	(512) 795-0360	F	PCCA Turnpike 6703180051	
Fax	(512) 795-8423	Fax	(512) 795-8423	G		
e-Mail Address	carl.teinert@woodplc.com	e-Mail Address	carl.teinert@woodplc.com	H		
				I		
				J		

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	L-1	2/4/19	1155	Sediment	8	2	X	X									
2	L-2	2/5/19	1015	Sediment	8	2	X	X									
3	L-3	2/5/19	1055	Sediment	8	2	X	X									
4	L-4	2/5/19	1515	Sediment	8	2	X	X									
5	L-5	2/5/19	1620	Sediment	8	2	X	X									
6	L-6 NO SAMPLE CF	X	X	Sediment	8 CF	2	X	X									
7	L-7	2/4/19	1530	Sediment	8	2	X	X									
8	L-8	2/4/19	1440	Sediment	8	2	X	X									
9	L-9	2/6/19	1505	Sediment	8	2	X	X									
10	L-10	2/6/19	1407	Sediment	8	2	X	X									

Sampler(s) Please Print & Sign: CAT, SCH, AB

Shipment Method: AGS / Greyhound

Required Turnaround Time: (Check Box) ☐ Other ____ ☒ STD 10 Wk Days ☐ 5 Wk Days ☐ 2 Wk Days ☐ 24 Hour

Results Due Date:

Relinquished by:	Date:	Time:	Received by:
	2/6/19	1900	
Relinquished by:	Date:	Time:	Received by (Laboratory):
			DC 2/7/19 07:30
Logged by (Laboratory):	Date:	Time:	Checked by (Laboratory):

Notes: PCCA Turnpike

Cooler ID	Cooler Temp.
	01C.
4417	0.2°
	#2
	C/F 0.3°

QC Package: (Check One Box Below)
☐ Level II Std QC ☒ TRRP Checklist
☐ Level III Std QC/Raw Data ☐ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other

23954 - 0.5°
43777 - 0.3°.

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

Note: 1. Any changes must be made in writing once samples and COC Form have been submitted to ALS Environmental.
2. Unless otherwise agreed in a formal contract, services provided by ALS Environmental are expressly limited to the terms and conditions stated on the reverse.
3. The Chain of Custody is a legal document. All information must be completed accurately.

Cincinnati, OH +1 513 733 5336
Everett, WA +1 425 356 2600
Fort Collins, CO +1 970 490 1511
Holland, MI +1 616 399 6070
Houston, TX +1 281 530 5656
Middletown, PA +1 717 944 5541
Spring City, PA +1 610 948 4903
Salt Lake City, UT +1 801 266 7700
South Charleston, WV +1 304 356 3168
York, PA +1 717 505 5280

Chain of Custody Form

COC ID: 198652

ALS Project Manager: | ALS Work Order #:

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order	6703180051.0003	Project Name	PCCA Turnpike 6703180051	A	TOC_S (9060 TOC)
Work Order		Project Number	6703180051.0003	B	SUB_GRAINSIZE (ASTM D422 Grain Size (Sub TWE))
Company Name	Wood Environment & Infrastructure	Bill To Company	Wood Environment & Infrastructure	C	
Send Report To	Carl Teinert	Invoice Attn	Carl Teinert	D	
Address	3755 S. Capital of Texas Highway Ste. 375	Address	3755 S. Capital of Texas Highway Ste. 375	E	HS19020370
				F	Wood Environment & Infrastructure Solutions PCCA Turnpike 6703180051
City/State/Zip	Austin, TX 78704	City/State/Zip	Austin TX 78704	G	
Phone	(512) 795-0360	Phone	(512) 795-0360	H	
Fax	(512) 795-8423	Fax	(512) 795-8423	I	
e-Mail Address	carl.teinert@woodplc.com	e-Mail Address	carl.teinert@woodplc.com	J	

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	L-11	2/5/19	1400	Sediment	8	2	X	X									
2	L-12	2/6/19	1325	Sediment	8	2	X	X									
3	L-13	2/5/19	1251	Sediment	8	2	X	X									
4	L-14	2/5/19	1200	Sediment	8	2	X	X									
5	L-15	2/6/19	1305	Sediment	8	2	X	X									
6																	
7																	
8																	
9																	
10																	

Sampler(s) Please Print & Sign: CRT, SCM, AB

Shipment Method: ALS / Greyhound

Required Turnaround Time: (Check Box) ☐ Other ____ ☒ STD 10 Wk Days ☐ 5 Wk Days ☐ 2 Wk Days ☐ 24 Hour

Results Due Date:

Relinquished by:	Date: 2/6/19	Time: 1900	Received by:	
Relinquished by:	Date:	Time:	Received by (Laboratory): DG 2/7/19 07:30.	
Logged by (Laboratory):	Date:	Time:	Checked by (Laboratory):	

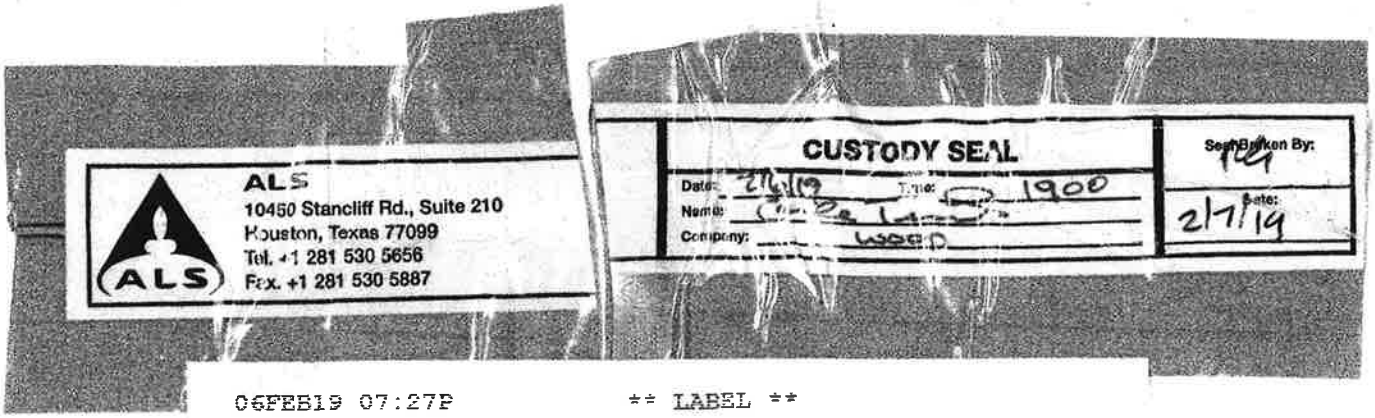
Notes: PCCA Turnpike

Cooler ID	Cooler Temp.

QC Package: (Check One Box Below)
☐ Level II Std QC ☒ TRRP Checklist
☐ Level III Std QC/Raw Data ☐ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other ____

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

Note: 1. Any changes must be made in writing once samples and COC Form have been submitted to ALS Environmental.
2. Unless otherwise agreed in a formal contract, services provided by ALS Environmental are expressly limited to the terms and conditions stated on the reverse.
3. The Chain of Custody is a legal document. All information must be completed accurately.



06FEB19 07:27P ** LABEL **

Schd: VLP 0854

GLI 3086408919

HOUSTON, TX

n: ALS DALLAS
281-530-5656

/: ALS GLOBAL DALLAS
10450 STANCLIFF RD

HOUSTON, TX 77099

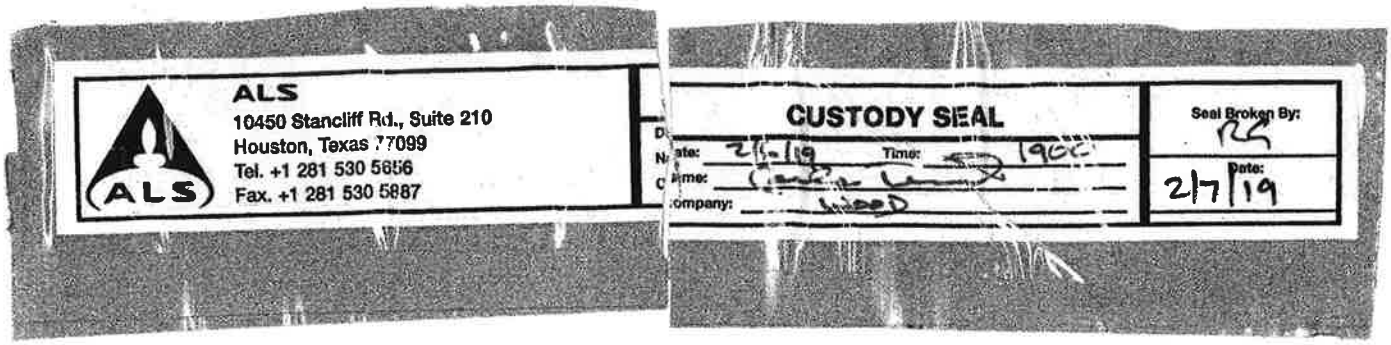
Phone: 281-530-5656

Manual Wght:
109.0
Tariff Wght:
109.0

PO/Ref #:

Priority

Agency Phone: (713)759-6550 WWW.SHIPGREYHOUND.COM



06FEB19 07:27P ** LABEL **

Schd: VLP 0854

GLI 3086408919

HOUSTON, TX

1: ALS DALLAS
281-530-5656

7: ALS GLOBAL DALLAS
10450 STANCLIFF RD

HOUSTON, TX 77099
Phone: 281-530-5656
Priority
Agency Phone: (713)759-6550

Manual Wght:
109.0
Tariff Wght:
109.0

PO/Ref #:

WWW.SHIPGREYHOUND.COM

06FEB19 07:27P ** LABEL **

Schd: VLP 0854

GLI 3086408919

HOUSTON, TX

A: ALS DALLAS
281-530-5656

T: ALS GLOBAL DALLAS
10450 STANCLIFF RD

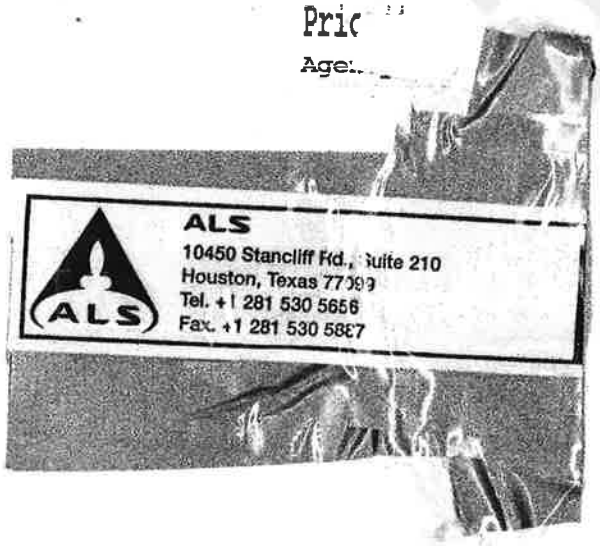
HOUSTON, TX 77099
Phone: 281-530-5656

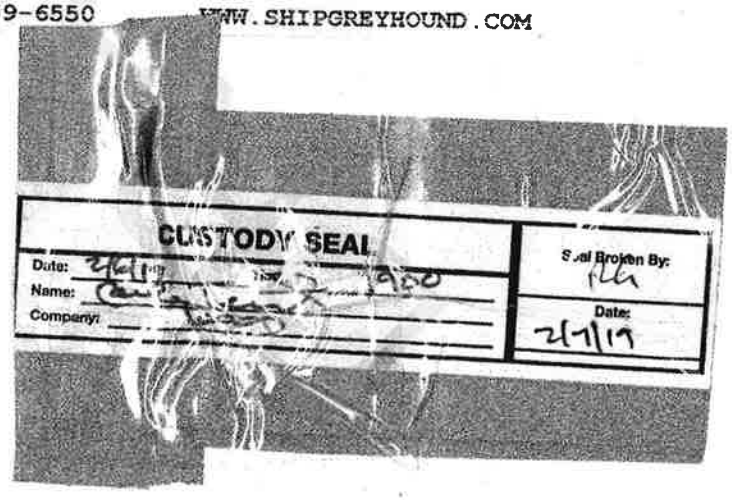
Manual Wght:
109.0
Tariff Wght:
109.0

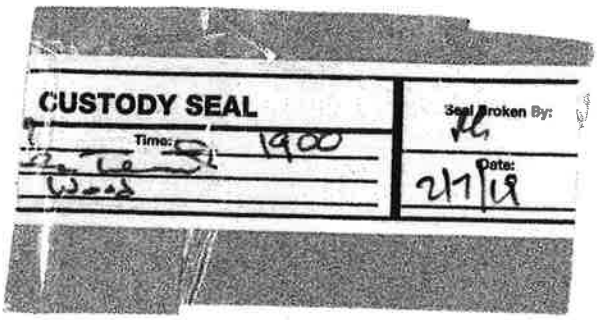
PO/Ref #:

Pric

Age: 759-6550 WWW.SHIPGREYHOUND.COM







Tolunay-Wong Engineers, Inc.

10710 S. Sam Houston Parkway W., Suite 100 * Houston, TX 77031 * Phone (713) 722-7064 * Fax (713) 722-0319

Mr. Dane Wacasey
ALS
450 Stancliff Rd, Ste 210
Houston, TX 77099

February 22, 2019
TWE Project No. 19.14.025
Clients Chain of Custody Number: 10715
Clients Purchase Order Number: HS19020370

Re: Laboratory Test Results

Dear Mr. Wacasey:

Attached are the results of the laboratory testing performed on the samples delivered to our laboratory in Houston, Texas on February 8, 2019 for the subject project.

The testing consisted of 14 hydrometer analyses.

D-422 was withdrawn by ASTM in 2016 and has not been reinstated or replaced.

We hope this report satisfies your testing requirements at this time. The invoice will be sent separately.

We thank you for the opportunity to serve you, and look forward to working with you on future projects.

Sincerely,
TOLUNAY- WONG ENGINEERS, INC.

Patricia Hodgkins

Patricia Hodgkins
Geotechnical Laboratory Manager

Encl:
Customer Survey (1)
Clients Chain of Custody (2)
Hydrometer & Sieve Report (42)

10450 Stancliff Rd, Ste 210
Houston, TX 77099
T: +1 281 530 5656
F: +1 281 530 5887
www.alsglobal.com

Subcontract Chain of Custody

COC ID: 10715

19.14.025
Includes GEO system printout w/report to client

SUBCONTRACT TO:

Tolunay-Wong
10710 S. Sam Houston Parkway WestSuite 100
Houston, TX 77031

Phone: +1 713 722 7064

CUSTOMER INFORMATION:

Company:	ALS Houston
Contact:	Dane J. Wacasey
Address:	10450 Stancliff Rd, Ste 210
Phone:	+1 281 530 5656
Email:	Dane.Wacasey@alsglobal.com
Alternate Contact:	Jumoke M. Lawal
Email:	jumoke.lawal@alsglobal.com

INVOICE INFORMATION:

Company:	ALS Houston
Contact:	Accounts Payable
Address:	10450 Stancliff Rd, Ste 210
Phone:	+1 281 530 5656
Reference:	HS19020370
TSR:	Danielle Winnings

	LAB SAMPLE ID	CLIENT SAMPLE ID	MATRIX	COLLECT DATE
	ANALYSIS REQUESTED			DUE DATE
1.	**HS19020370-01**	**L-1**	**Sediment**	**04 Feb 2019 11:55**
	D422-63; Sieve+Hydrom; Need D50 values, 10 day TAT			21 Feb 2019
2.	**HS19020370-02**	**L-2**	**Sediment**	**05 Feb 2019 10:15**
	D422-63; Sieve+Hydrom; Need D50 values, 10 day TAT			21 Feb 2019
3.	**HS19020370-03**	**L-3**	**Sediment**	**05 Feb 2019 10:55**
	D422-63; Sieve+Hydrom; Need D50 values, 10 day TAT			21 Feb 2019
4.	**HS19020370-04**	**L-4**	**Sediment**	**05 Feb 2019 15:15**
	D422-63; Sieve+Hydrom; Need D50 values, 10 day TAT			21 Feb 2019
5.	**HS19020370-05**	**L-5**	**Sediment**	**05 Feb 2019 16:20**
	D422-63; Sieve+Hydrom; Need D50 values, 10 day TAT			21 Feb 2019
6.	**HS19020370-06**	**L-7**	**Sediment**	**04 Feb 2019 15:30**
	D422-63; Sieve+Hydrom; Need D50 values, 10 day TAT			21 Feb 2019
7.	**HS19020370-07**	**L-8**	**Sediment**	**04 Feb 2019 14:40**
	D422-63; Sieve+Hydrom; Need D50 values, 10 day TAT			21 Feb 2019
8.	**HS19020370-08**	**L-9**	**Sediment**	**06 Feb 2019 15:05**
	D422-63; Sieve+Hydrom; Need D50 values, 10 day TAT			21 Feb 2019
9.	**HS19020370-09**	**L-10**	**Sediment**	**06 Feb 2019 14:07**

Subcontract Chain of Custody

COC ID: 10715

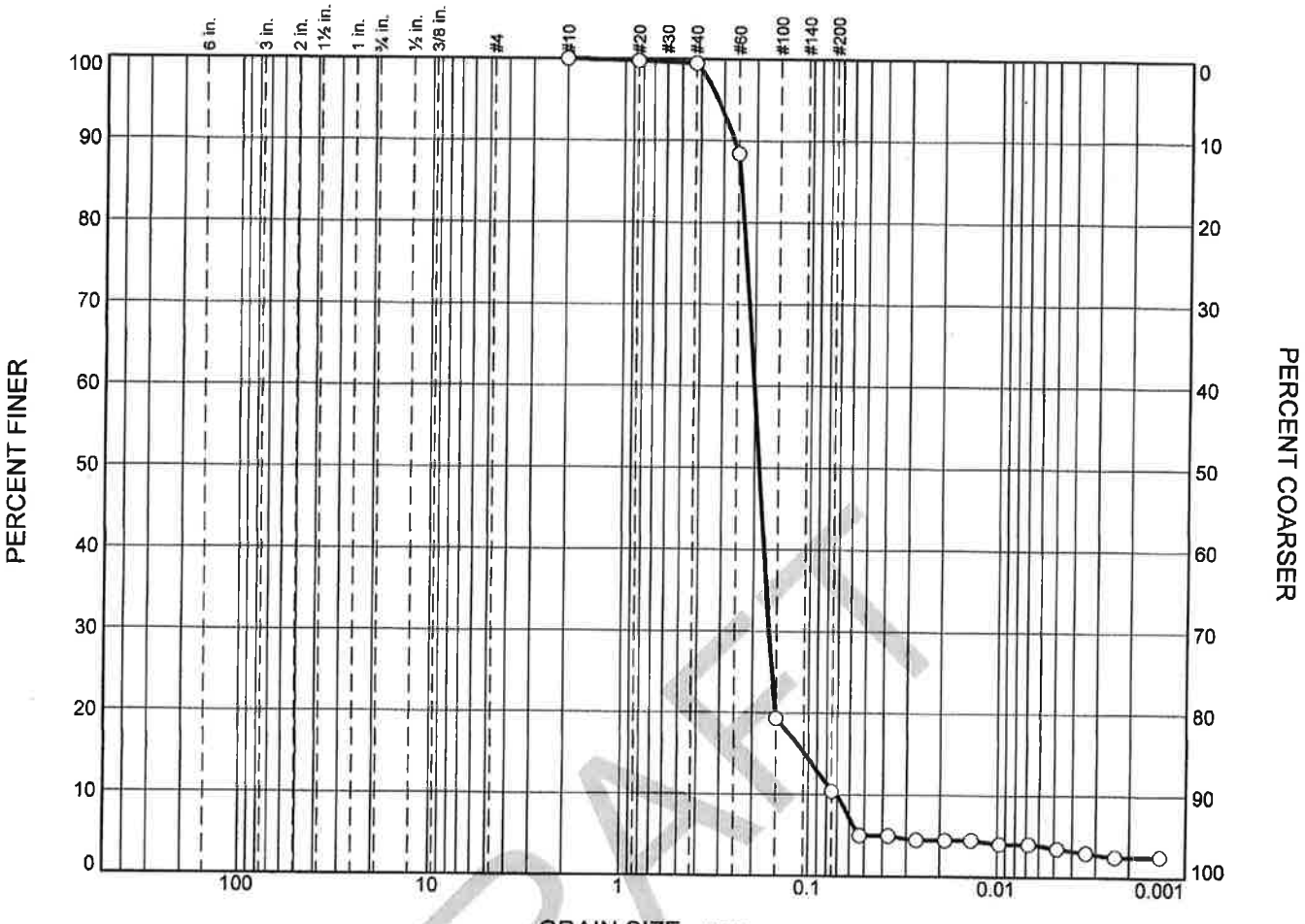
	LAB SAMPLE ID	CLIENT SAMPLE ID	MATRIX	COLLECT DATE
	ANALYSIS REQUESTED			DUE DATE
	D422-63; Sieve+Hydrom; Need D50 values, 10 day TAT			21 Feb 2019
10.	**HS19020370-10**	**L-11**	**Sediment**	**05 Feb 2019 14:00**
	D422-63; Sieve+Hydrom; Need D50 values, 10 day TAT			21 Feb 2019
11.	**HS19020370-11**	**L-12**	**Sediment**	**04 Feb 2019 13:25**
	D422-63; Sieve+Hydrom; Need D50 values, 10 day TAT			21 Feb 2019
12.	**HS19020370-12**	**L-13**	**Sediment**	**05 Feb 2019 12:51**
	D422-63; Sieve+Hydrom; Need D50 values, 10 day TAT			21 Feb 2019
13.	**HS19020370-13**	**L-14**	**Sediment**	**05 Feb 2019 12:00**
	D422-63; Sieve+Hydrom; Need D50 values, 10 day TAT			21 Feb 2019
14.	**HS19020370-14**	**L-15**	**Sediment**	**06 Feb 2019 13:05**
	D422-63; Sieve+Hydrom; Need D50 values, 10 day TAT			21 Feb 2019

Comments: Please analyze for the analysis listed above.
Send report to the emails shown above.

QC Level: TRRP LRC (TRRP checklist only+Level II (normal))

Relinquished By:	D	**Date/Time:**	2.8.19 1140
Received By:		**Date/Time:**	
Cooler ID(s):		**Temperature(s):**	

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.5	89.1	7.9	2.5

SOIL DATA

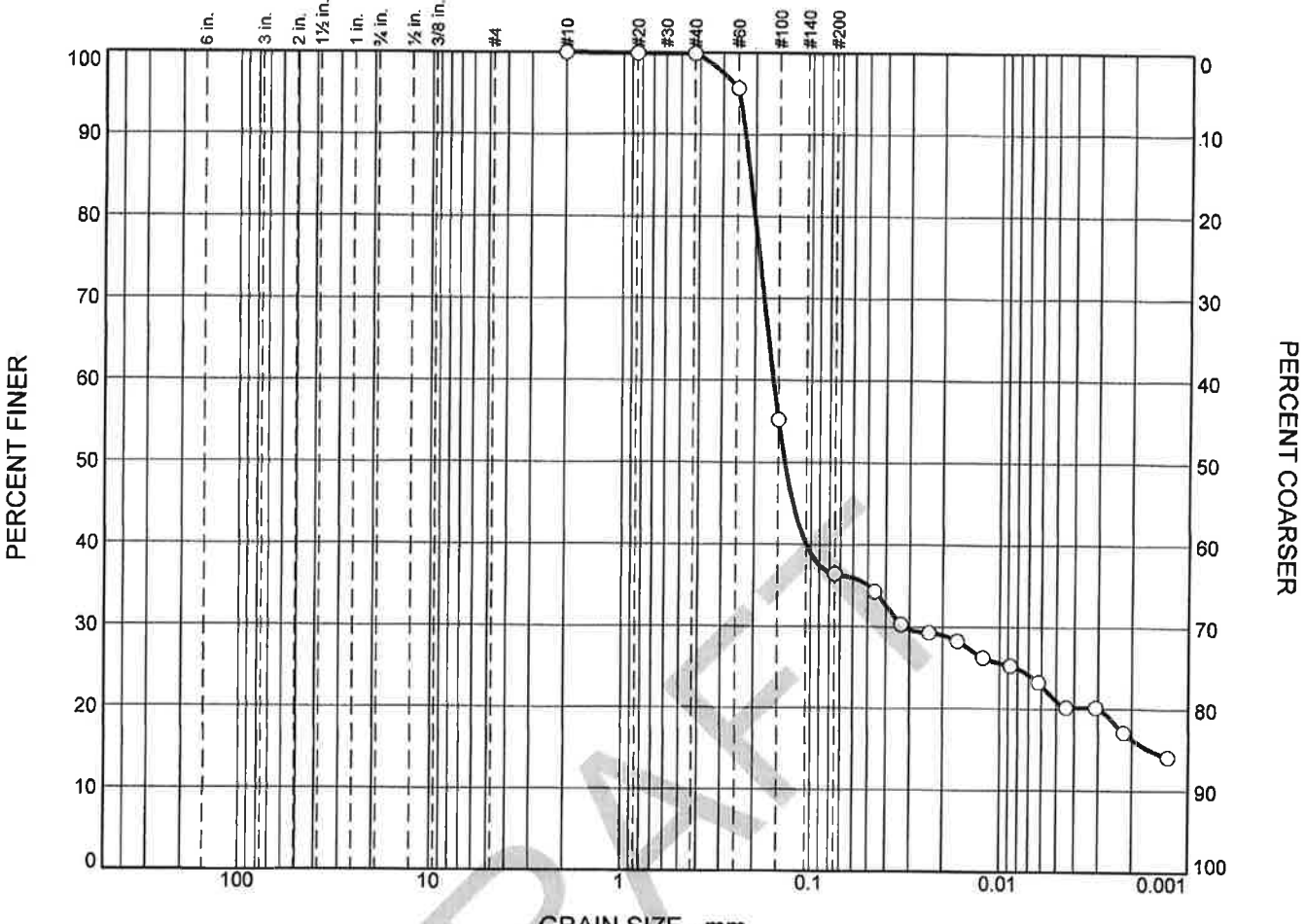
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	HS19020370	01-L1			SP-SM

Tolunay-Wong Engineers, Inc.
Houston, Texas

Client: ALS
Project: ALS
HS19020370
Project No.: 19.14.025

Figure

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	63.4	20.2	16.3

SOIL DATA

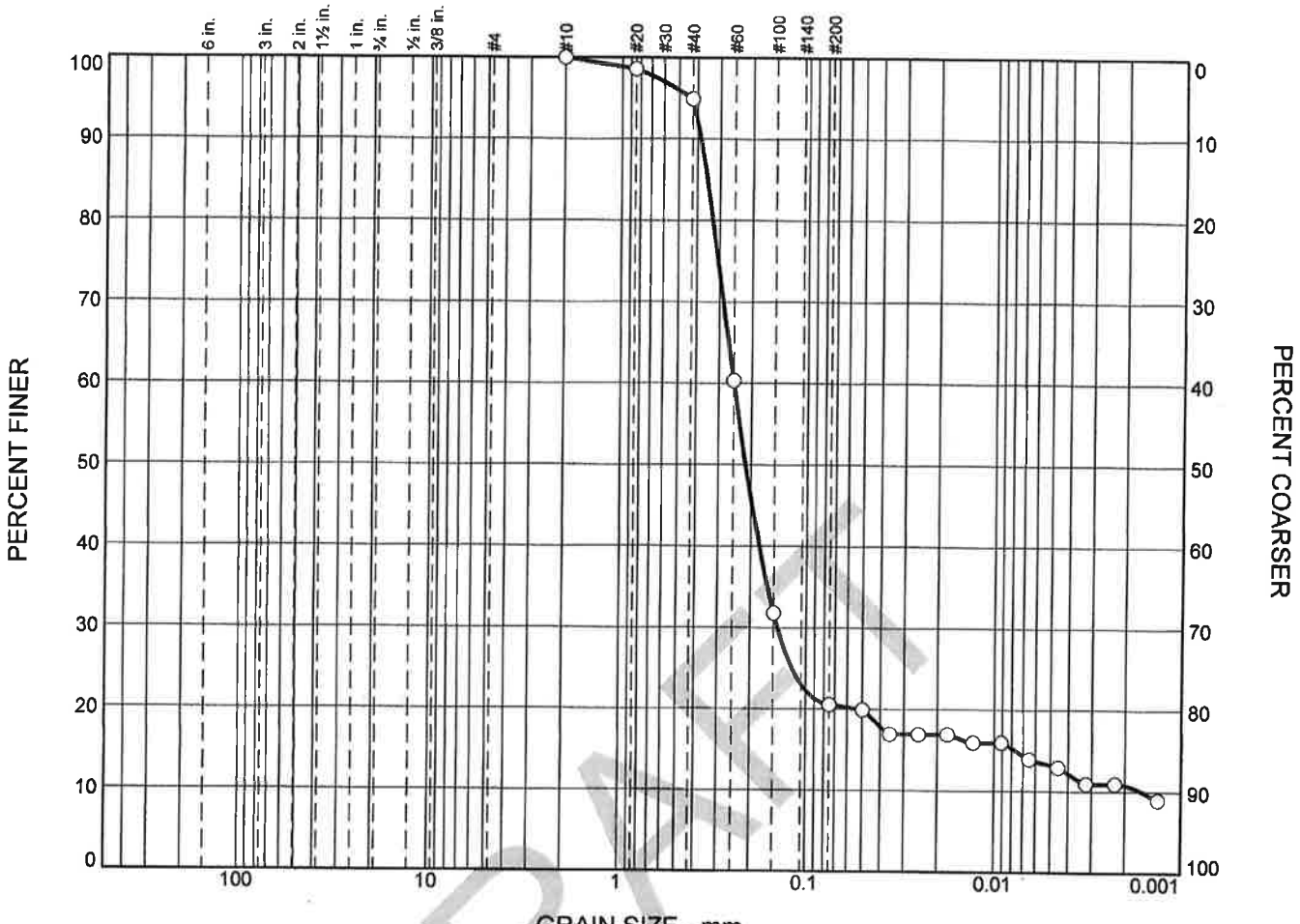
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	HS19020370	02-L2			SC

Tolunay-Wong Engineers, Inc.
Houston, Texas

Client: ALS
Project: ALS
HS19020370
Project No.: 19.14.025

Figure

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	5.1	74.3	9.8	10.8

SOIL DATA

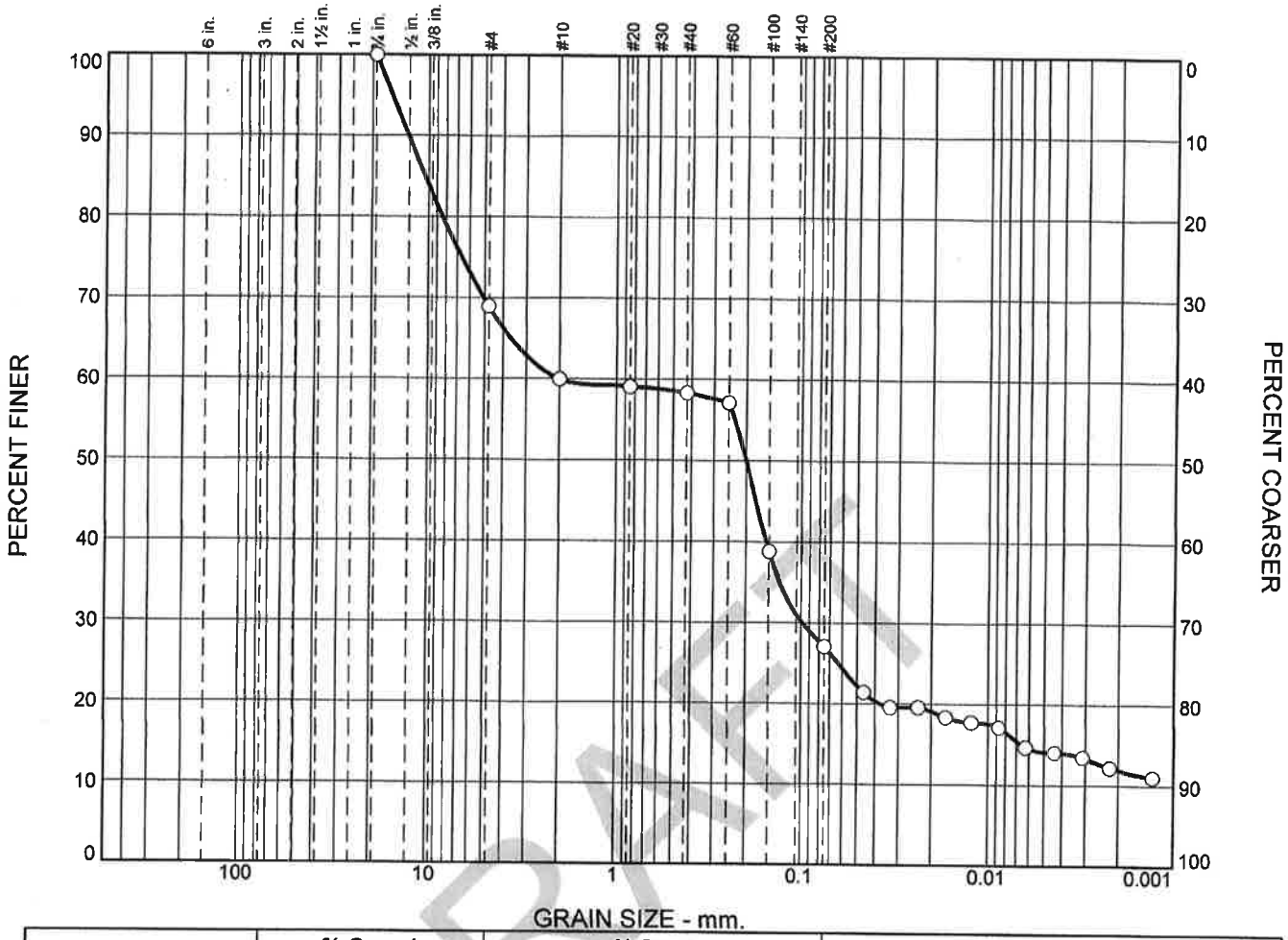
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	HS19020370	03-L3			ML

Tolunay-Wong Engineers, Inc.
Houston, Texas

Client: ALS
Project: ALS
HS19020370
Project No.: 19.14.025

Figure

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	31.1	8.9	1.7	31.2	15.2	11.9

SOIL DATA

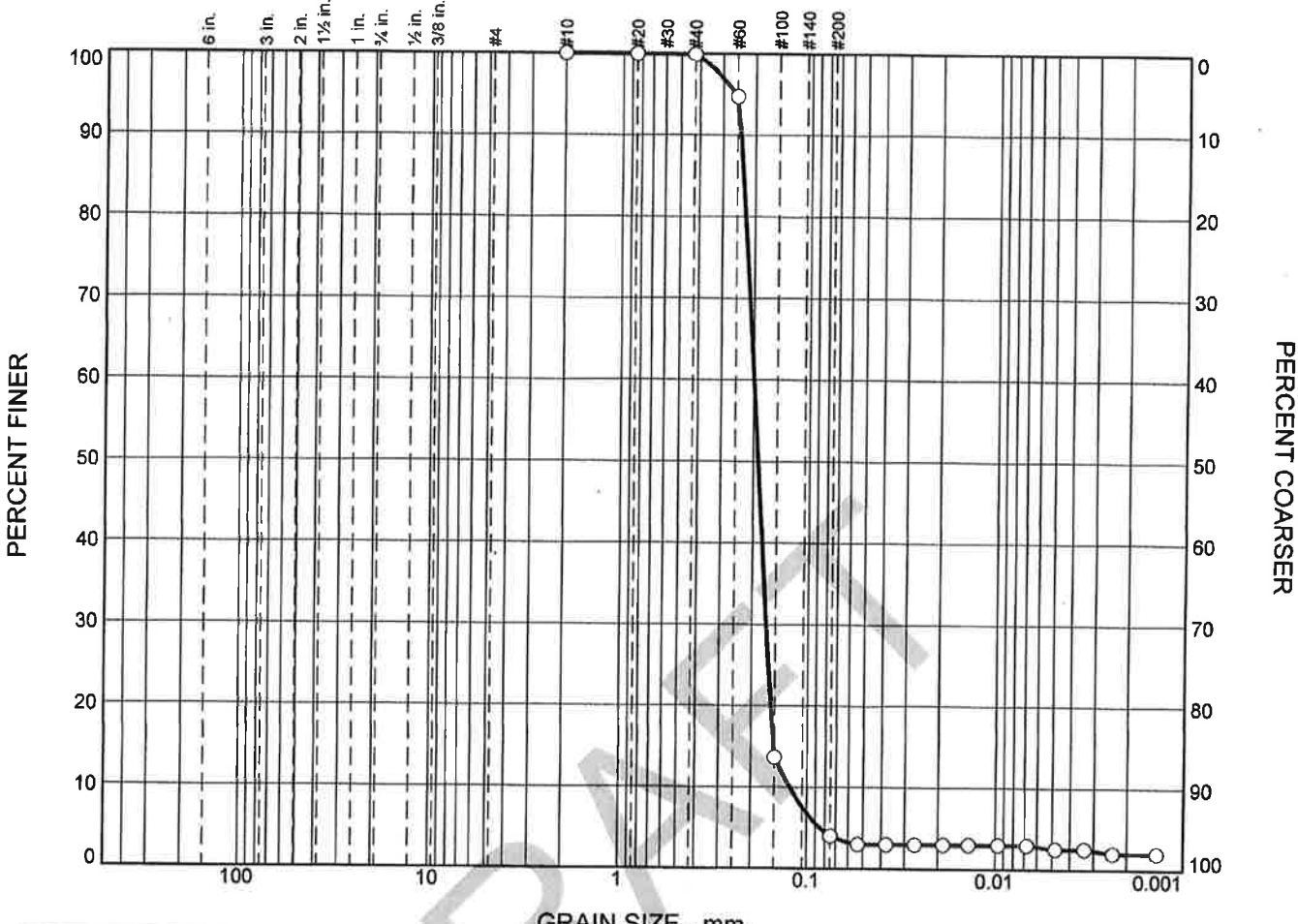
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	HS19020370	04-L4			SC

Tolunay-Wong Engineers, Inc.
Houston, Texas

Client: ALS
Project: ALS
HS19020370
Project No.: 19.14.025

Figure

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	95.9	2.0	2.0

SOIL DATA

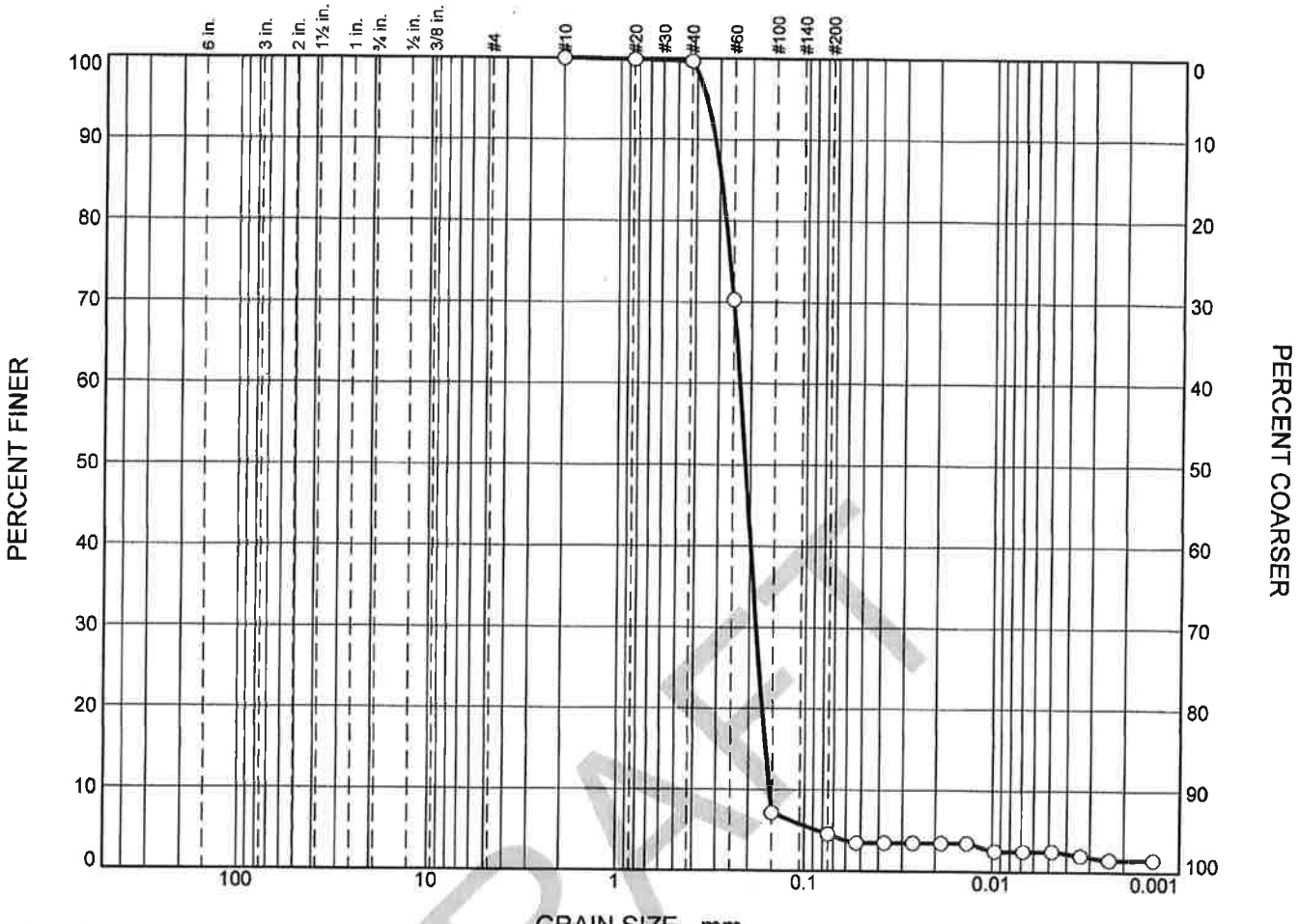
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	HS19020370	05-L5			SP

Tolunay-Wong Engineers, Inc.
Houston, Texas

Client: ALS
Project: ALS
HS19020370
Project No.: 19.14.025

Figure

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.4	95.0	3.1	1.5

SOIL DATA

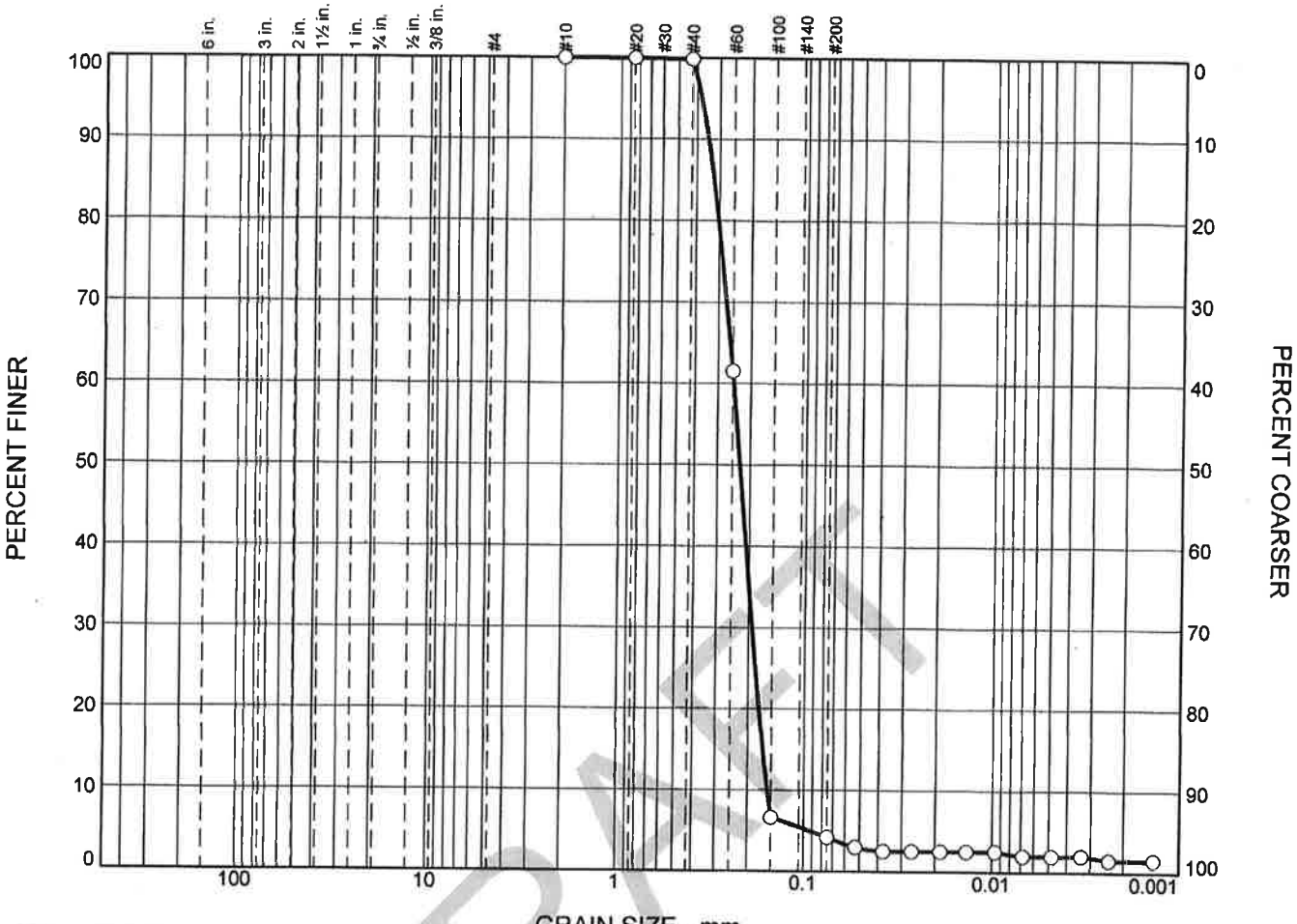
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	HS19020370	06-L7			SP

Tolunay-Wong Engineers, Inc.
Houston, Texas

Client: ALS
Project: ALS
HS19020370
Project No.: 19.14.025

Figure

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	95.6	2.7	1.5

SOIL DATA

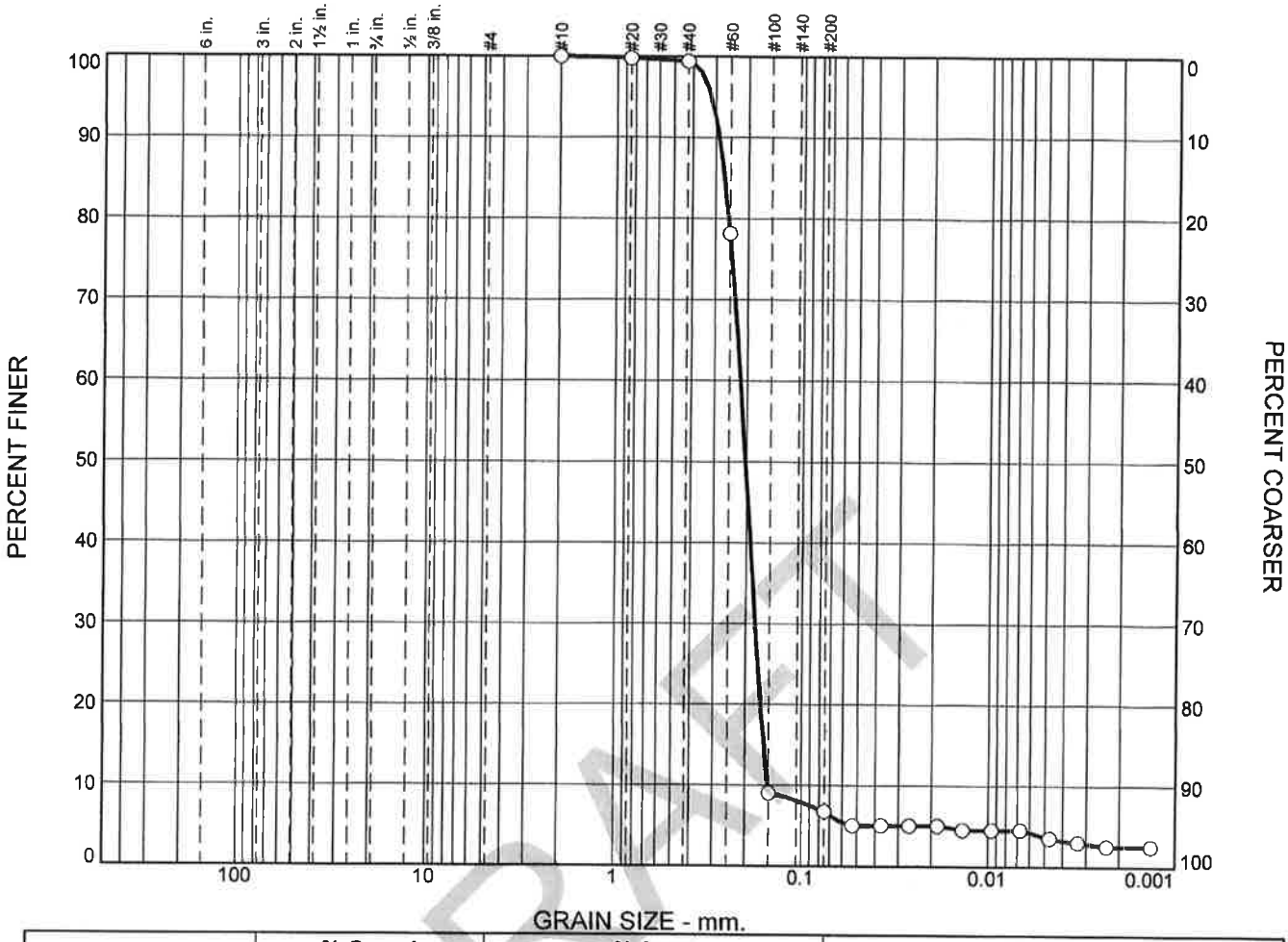
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	HS19020370	07-L8			SP

Tolunay-Wong Engineers, Inc.
Houston, Texas

Client: ALS
Project: ALS
HS19020370
Project No.: 19.14.025

Figure

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.6	92.7	4.2	2.5

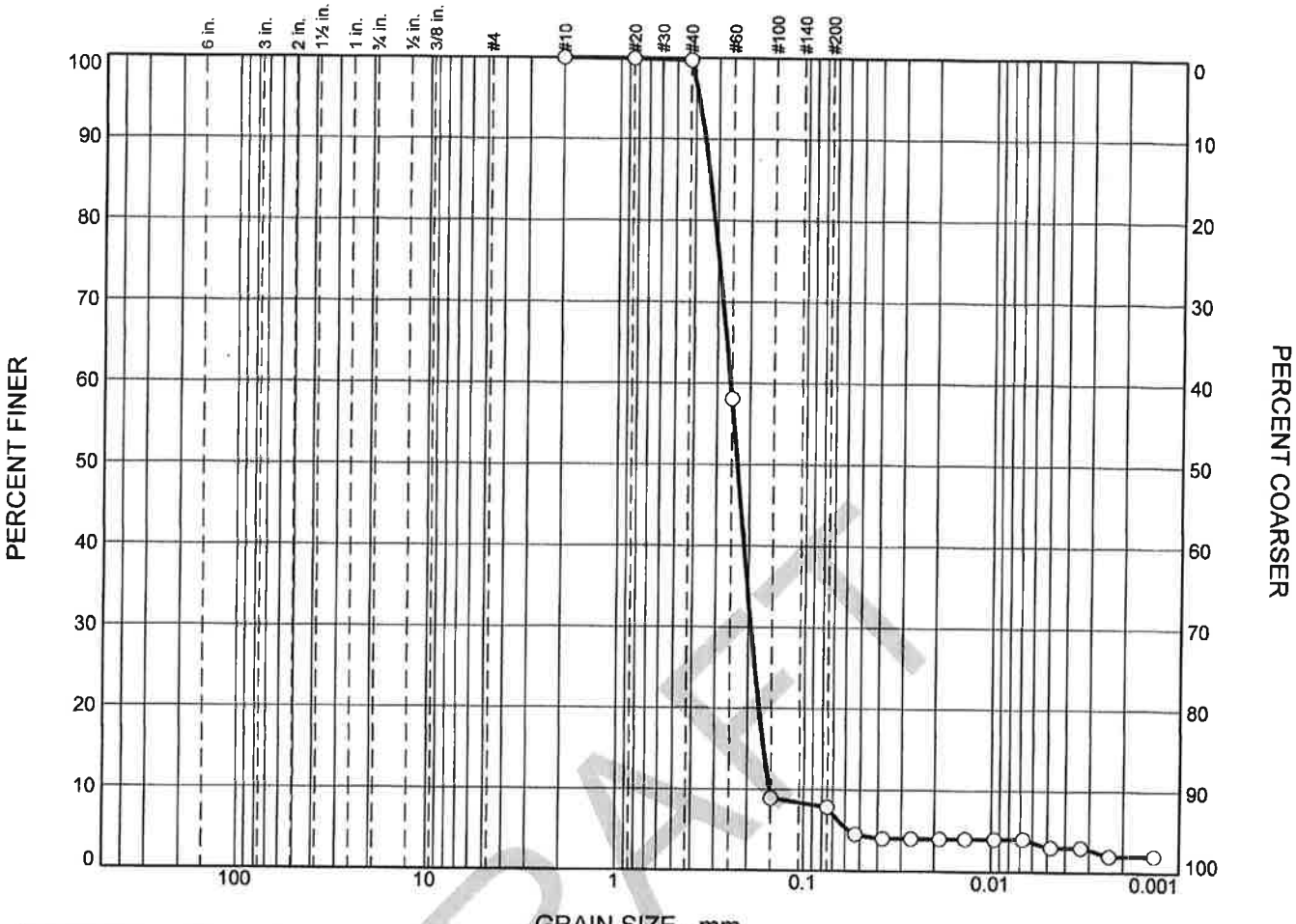
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	HS19020370	08-L9			SP-SM

Tolunay-Wong Engineers, Inc. Houston, Texas	**Client:** ALS **Project:** ALS HS19020370 **Project No.:** 19.14.025

Figure

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○					0.3	91.8	5.9	2.0

SOIL DATA

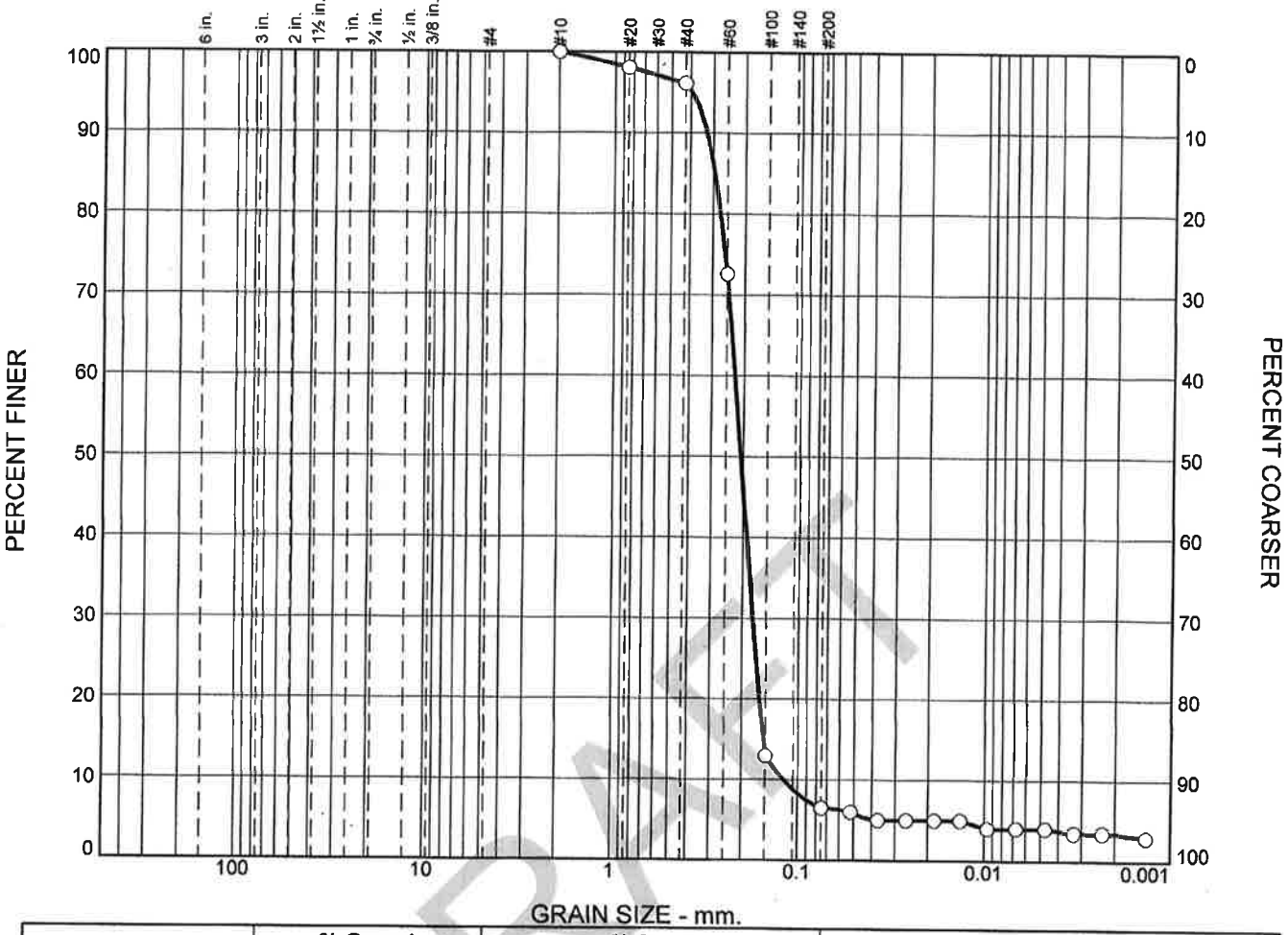
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	HS19020370	09-L10			SP-SM

Tolunay-Wong Engineers, Inc.
Houston, Texas

Client: ALS
Project: ALS
HS19020370
Project No.: 19.14.025

Figure

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	3.9	89.6	3.0	3.5

SOIL DATA

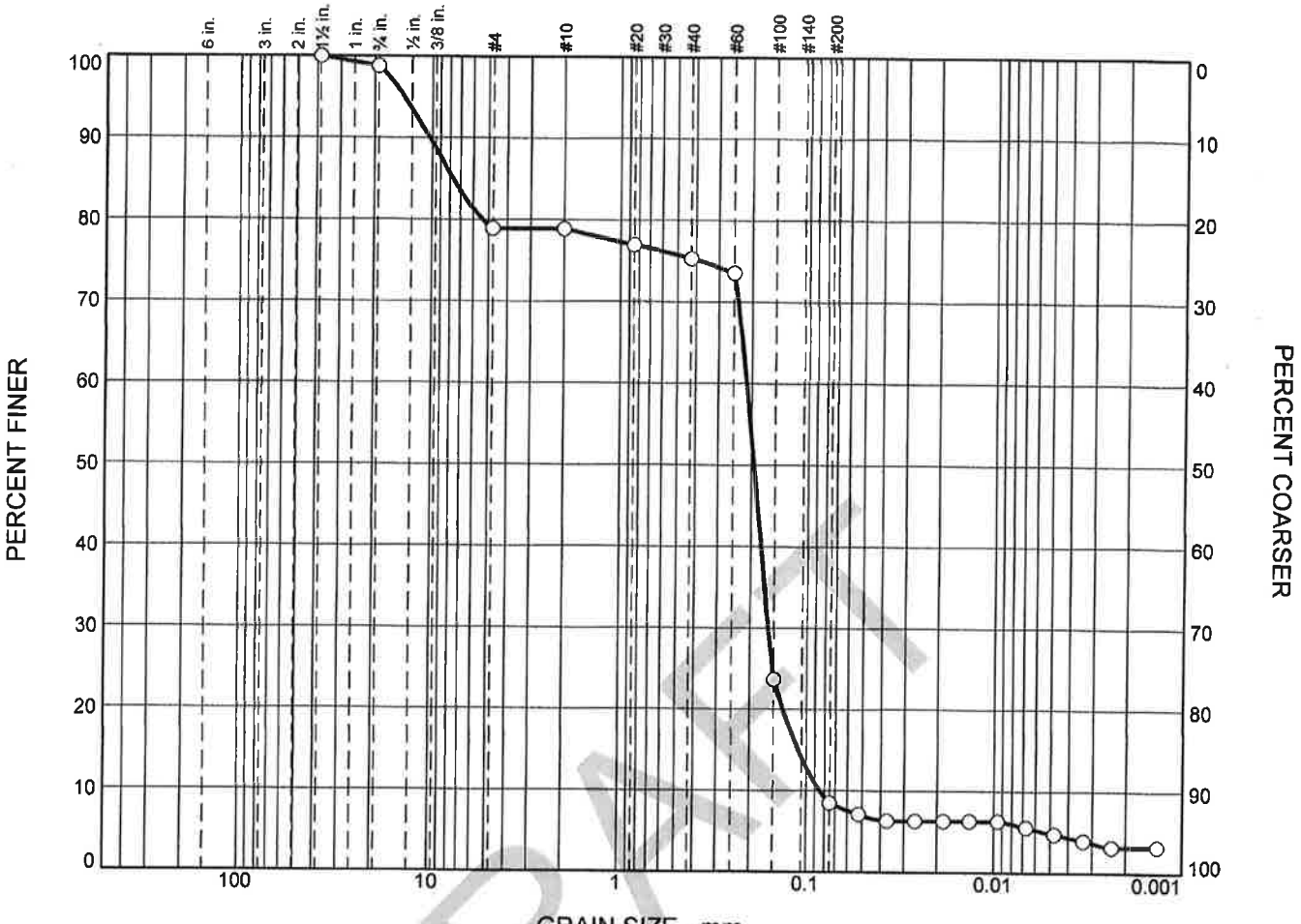
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	HS19020370	010-L11			SP-SM

Tolunay-Wong Engineers, Inc.
Houston, Texas

Client: ALS
Project: ALS
HS19020370
Project No.: 19.14.025

Figure

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	1.2	19.9	0.0	3.6	66.8	5.3	3.2

SOIL DATA

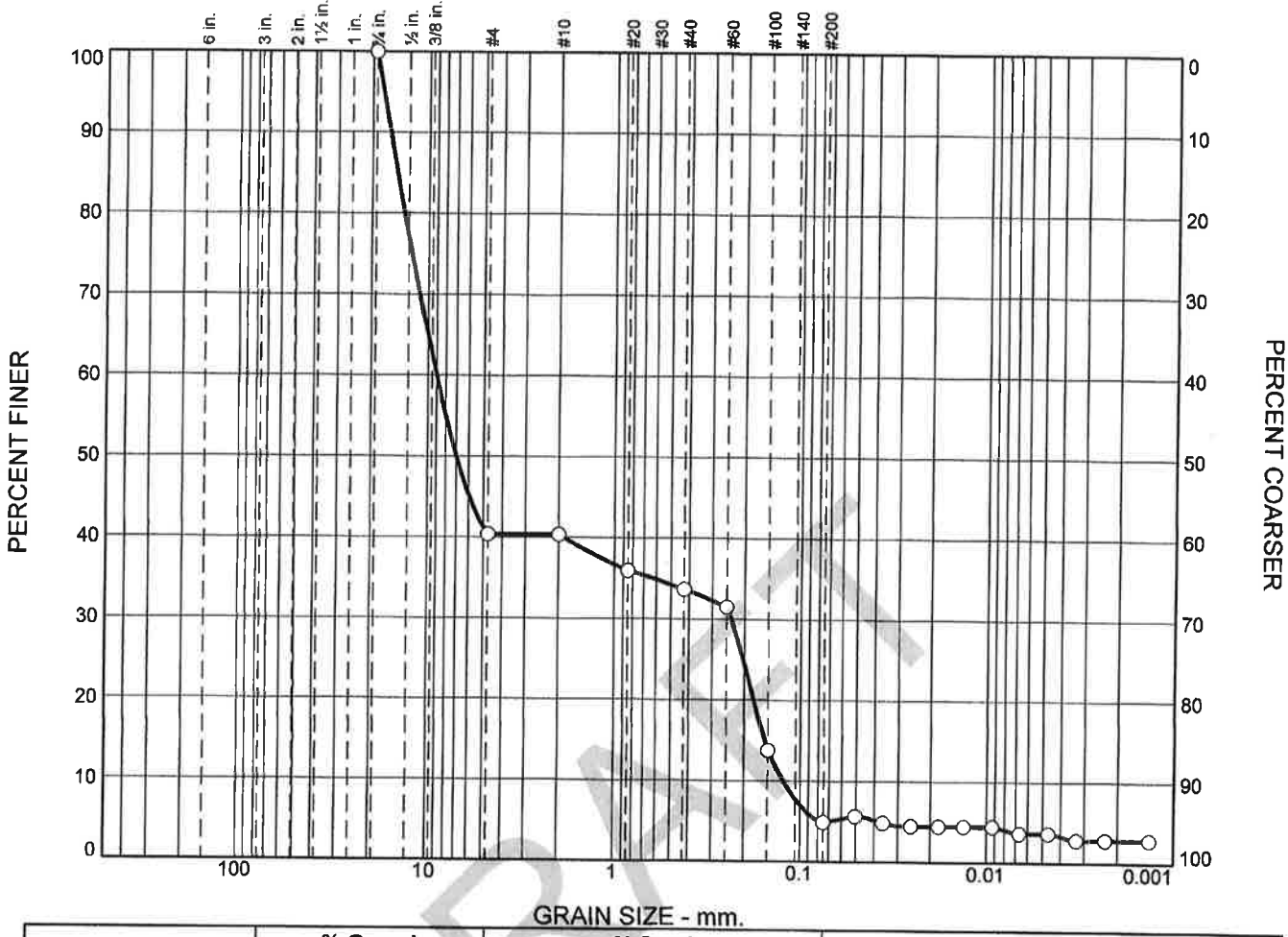
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	HS19020370	011-L12			SP-SM

Tolunay-Wong Engineers, Inc.
Houston, Texas

Client: ALS
Project: ALS
HS19020370
Project No.: 19.14.025

Figure

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	59.6	0.0	6.8	28.7	2.1	2.8

SOIL DATA

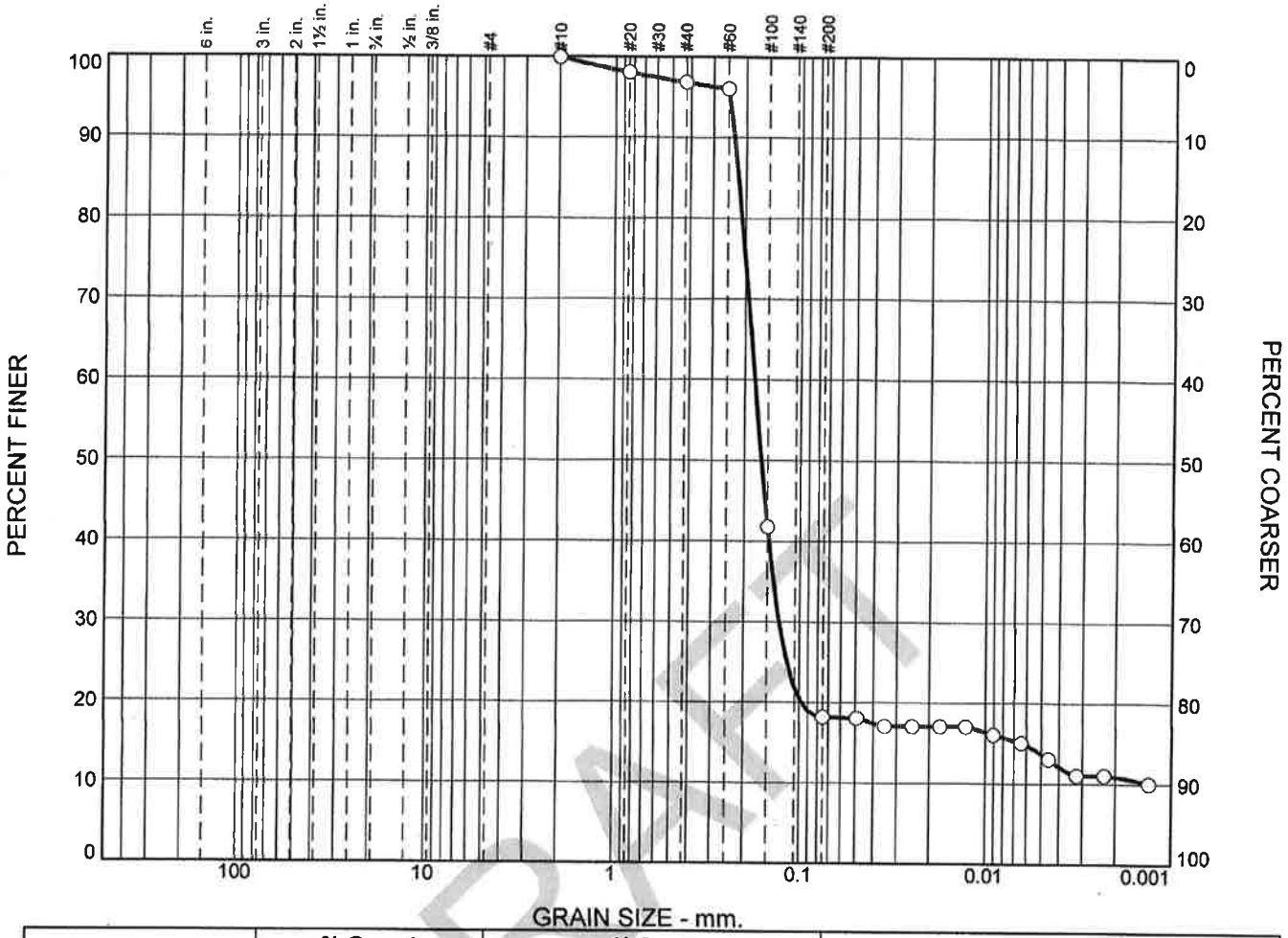
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	HS19020370	012-L13			GP

Tolunay-Wong Engineers, Inc.
Houston, Texas

Client: ALS
Project: ALS
HS19020370
Project No.: 19.14.025

Figure

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○					3.2	78.6	7.3	10.9

SOIL DATA

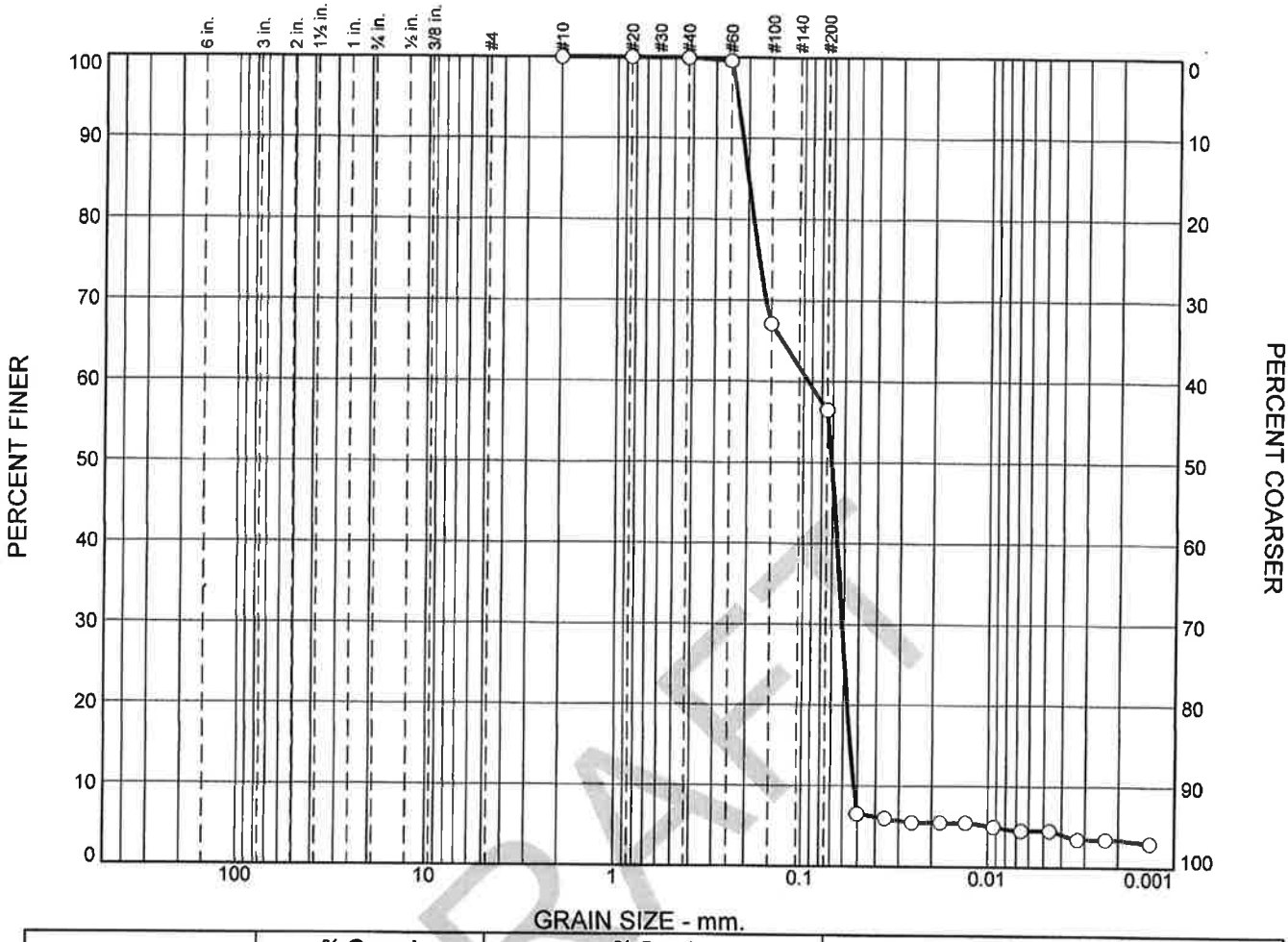
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	HS19020370	013-L14			SC

Tolunay-Wong Engineers, Inc.
Houston, Texas

Client: ALS
Project: ALS
HS19020370
Project No.: 19.14.025

Figure

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○					0.1	43.4	53.1	3.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	HS19020370	014-L15			ML

Tolunay-Wong Engineers, Inc.
Houston, Texas

Client: ALS
Project: ALS
HS19020370
Project No.: 19.14.025

Figure

GRAIN SIZE DISTRIBUTION TEST DATA

2/22/2019

Client: ALS
Project: ALS
HS19020370
Project Number: 19.14.025
Location: HS19020370
Sample Number: 01-L1
USCS: SP-SM

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Percent Retained
318.50	218.50	218.50	#10	218.50	100.0	0.0
			#20	218.76	99.7	0.3
			#40	219.01	99.5	0.5
			#60	230.10	88.4	11.6
			#100	299.17	19.3	80.7
			#200	308.11	10.4	89.6

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100.0
Weight of hydrometer sample =100
Hygroscopic moisture correction:
Moist weight and tare = 118.85
Dry weight and tare = 118.74
Tare weight = 30.62
Hygroscopic moisture = 0.1%
Table of composite correction values:

Temp., deg. C:	15.0	18.4
Comp. corr.:	-6.0	-6.0

Meniscus correction only = 0.5
Specific gravity of solids = 2.65
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 x Rm

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer	Percent Retained
1.00	15.0	11.0	5.0	0.0145	11.5	13.3	0.0530	5.0	95.0
2.00	15.0	11.0	5.0	0.0145	11.5	13.3	0.0374	5.0	95.0
4.00	15.1	10.5	4.5	0.0145	11.0	13.4	0.0266	4.5	95.5
8.00	15.2	10.5	4.5	0.0145	11.0	13.4	0.0188	4.5	95.5
15.00	15.2	10.5	4.5	0.0145	11.0	13.4	0.0137	4.5	95.5
30.00	15.5	10.0	4.0	0.0145	10.5	13.5	0.0097	4.0	96.0
60.00	16.1	10.0	4.0	0.0143	10.5	13.5	0.0068	4.0	96.0
120.00	16.6	9.5	3.5	0.0142	10.0	13.6	0.0048	3.5	96.5
240.00	17.6	9.0	3.0	0.0141	9.5	13.8	0.0034	3.0	97.0
480.00	18.4	8.5	2.5	0.0139	9.0	13.9	0.0024	2.5	97.5
1440.00	17.8	8.5	2.5	0.0140	9.0	13.9	0.0014	2.5	97.5

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	0.5	89.1	89.6	7.9	2.5	10.4

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0373	0.0707	0.1048	0.1510	0.1646	0.1768	0.1888	0.2015	0.2319	0.2419	0.2642	0.3240

Fineness Modulus	C_u	C_c
0.88	2.85	1.90

GRAIN SIZE DISTRIBUTION TEST DATA

2/22/2019

Client: ALS
Project: ALS
HS19020370
Project Number: 19.14.025
Location: HS19020370
Sample Number: 02-L2
USCS: SC

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Percent Retained
268.32	218.32	218.32	#10	218.32	100.0	0.0
			#20	218.37	99.9	0.1
			#40	218.39	99.9	0.1
			#60	220.50	95.6	4.4
			#100	240.71	55.2	44.8
			#200	250.08	36.5	63.5

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100.0
Weight of hydrometer sample =50
Hygroscopic moisture correction:
Moist weight and tare = 93.87
Dry weight and tare = 92.53
Tare weight = 30.59
Hygroscopic moisture = 2.2%
Table of composite correction values:

Temp., deg. C:	14.5	17.9
Comp. corr.:	-6.0	-6.0

Meniscus correction only = 0.5
Specific gravity of solids = 2.70
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer	Percent Retained
1.00	14.5	23.0	17.0	0.0144	23.5	10.1	0.0458	34.4	65.6
2.00	14.5	21.0	15.0	0.0144	21.5	10.6	0.0332	30.3	69.7
4.00	14.6	20.5	14.5	0.0144	21.0	10.7	0.0236	29.3	70.7
8.00	14.6	20.0	14.0	0.0144	20.5	10.9	0.0168	28.3	71.7
15.00	15.0	19.0	13.0	0.0143	19.5	11.1	0.0123	26.3	73.7
30.00	15.3	18.5	12.5	0.0143	19.0	11.3	0.0087	25.3	74.7
60.00	15.8	17.5	11.5	0.0142	18.0	11.5	0.0062	23.2	76.8
120.00	16.6	16.0	10.0	0.0140	16.5	11.9	0.0044	20.2	79.8
240.00	17.8	16.0	10.0	0.0138	16.5	11.9	0.0031	20.2	79.8
480.00	17.9	14.5	8.5	0.0138	15.0	12.3	0.0022	17.2	82.8
1440.00	17.9	13.0	7.0	0.0138	13.5	12.7	0.0013	14.1	85.9

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	0.1	63.4	63.5	20.2	16.3	36.5

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
		0.0016	0.0030	0.0319	0.1061	0.1381	0.1598	0.2011	0.2134	0.2280	0.2469

Fineness Modulus
0.47

GRAIN SIZE DISTRIBUTION TEST DATA

2/22/2019

Client: ALS
Project: ALS
HS19020370
Project Number: 19.14.025
Location: HS19020370
Sample Number: 03-L3
USCS: ML

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Percent Retained
265.48	215.48	215.48	#10	215.48	100.0	0.0
			#20	216.19	98.6	1.4
			#40	218.02	94.9	5.1
			#60	235.31	60.3	39.7
			#100	249.58	31.8	68.2
			#200	255.19	20.6	79.4

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100.0
Weight of hydrometer sample =50
Hygroscopic moisture correction:
Moist weight and tare = 119.10
Dry weight and tare = 118.37
Tare weight = 31.60
Hygroscopic moisture = 0.8%
Table of composite correction values:

Temp., deg. C:	14.6	18.3
Comp. corr.:	-6.0	-6.0

Meniscus correction only = 0.5
Specific gravity of solids = 2.70
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 x Rm

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer	Percent Retained
1.00	14.6	16.0	10.0	0.0144	16.5	11.9	0.0498	19.9	80.1
2.00	14.6	14.5	8.5	0.0144	15.0	12.3	0.0358	17.0	83.0
4.00	14.8	14.5	8.5	0.0144	15.0	12.3	0.0252	17.0	83.0
8.00	14.9	14.5	8.5	0.0144	15.0	12.3	0.0178	17.0	83.0
15.00	15.3	14.0	8.0	0.0143	14.5	12.5	0.0130	16.0	84.0
30.00	15.7	14.0	8.0	0.0142	14.5	12.5	0.0092	16.0	84.0
60.00	16.0	13.0	7.0	0.0141	13.5	12.7	0.0065	14.0	86.0
120.00	16.9	12.5	6.5	0.0140	13.0	12.9	0.0046	13.0	87.0
240.00	18.0	11.5	5.5	0.0138	12.0	13.1	0.0032	11.0	89.0
480.00	18.3	11.5	5.5	0.0137	12.0	13.1	0.0023	11.0	89.0
1440.00	17.9	10.5	4.5	0.0138	11.0	13.4	0.0013	9.0	91.0

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	5.1	74.3	79.4	9.8	10.8	20.6

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
	0.0016	0.0077	0.0516	0.1426	0.1801	0.2143	0.2488	0.3274	0.3528	0.3836	0.4300

Fineness Modulus	C_u	C_c
0.98	153.91	50.58

GRAIN SIZE DISTRIBUTION TEST DATA

2/22/2019

Client: ALS
Project: ALS
HS19020370
Project Number: 19.14.025
Location: HS19020370
Sample Number: 04-L4
USCS: SC

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Percent Retained
411.38	268.26	268.26	.75	268.26	100.0	0.0
			#4	312.75	68.9	31.1
			#10	325.52	60.0	40.0
265.73	215.73	215.73	#20	216.50	59.1	40.9
			#40	217.11	58.3	41.7
			#60	218.07	57.2	42.8
			#100	233.39	38.8	61.2
			#200	243.17	27.1	72.9

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 60.0
Weight of hydrometer sample =50
Hygroscopic moisture correction:
Moist weight and tare = 106.55
Dry weight and tare = 105.03
Tare weight = 30.61
Hygroscopic moisture = 2.0%
Table of composite correction values:

Temp., deg. C:	15.6	18.2
Comp. corr.:	-6.0	-6.0

Meniscus correction only = -0.5
Specific gravity of solids = 2.65
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 x Rm

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer	Percent Retained
1.00	15.6	23.5	17.5	0.0144	23.0	10.2	0.0461	21.4	78.6
2.00	15.6	22.0	16.0	0.0144	21.5	10.6	0.0332	19.6	80.4
4.00	15.6	22.0	16.0	0.0144	21.5	10.6	0.0235	19.6	80.4
8.00	15.7	21.0	15.0	0.0144	20.5	10.9	0.0168	18.4	81.6
15.00	15.9	20.5	14.5	0.0144	20.0	11.0	0.0123	17.8	82.2
30.00	16.0	20.0	14.0	0.0144	19.5	11.1	0.0087	17.1	82.9
60.00	16.7	18.0	12.0	0.0142	17.5	11.7	0.0063	14.7	85.3
120.00	17.3	17.5	11.5	0.0141	17.0	11.8	0.0044	14.1	85.9
240.00	18.0	17.0	11.0	0.0140	16.5	11.9	0.0031	13.5	86.5
480.00	18.2	16.0	10.0	0.0140	15.5	12.2	0.0022	12.2	87.8
1440.00	18.0	15.0	9.0	0.0140	14.5	12.5	0.0013	11.0	89.0

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	31.1	31.1	8.9	1.7	31.2	41.8	15.2	11.9	27.1

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
		0.0066	0.0378	0.0982	0.1553	0.1999	2.0042	8.3806	10.4155	12.8039	15.6407

Fineness Modulus
2.73

GRAIN SIZE DISTRIBUTION TEST DATA

2/22/2019

Client: ALS
Project: ALS
HS19020370
Project Number: 19.14.025
Location: HS19020370
Sample Number: 05-L5
USCS: SP

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Percent Retained
316.30	216.30	216.30	#10	216.30	100.0	0.0
			#20	216.36	99.9	0.1
			#40	216.43	99.9	0.1
			#60	221.63	94.7	5.3
			#100	302.61	13.7	86.3
			#200	312.27	4.0	96.0

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100.0
Weight of hydrometer sample =100
Hygroscopic moisture correction:
Moist weight and tare = 120.13
Dry weight and tare = 119.94
Tare weight = 31.27
Hygroscopic moisture = 0.2%
Table of composite correction values:

Temp., deg. C:	16.1	18.6
Comp. corr.:	-6.0	-6.0

Meniscus correction only = 0.5
Specific gravity of solids = 2.65
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer	Percent Retained
1.00	16.1	9.0	3.0	0.0143	9.5	13.8	0.0532	3.0	97.0
2.00	16.1	9.0	3.0	0.0143	9.5	13.8	0.0376	3.0	97.0
4.00	16.2	9.0	3.0	0.0143	9.5	13.8	0.0266	3.0	97.0
8.00	16.2	9.0	3.0	0.0143	9.5	13.8	0.0188	3.0	97.0
15.00	16.2	9.0	3.0	0.0143	9.5	13.8	0.0137	3.0	97.0
30.00	16.6	9.0	3.0	0.0142	9.5	13.8	0.0097	3.0	97.0
60.00	16.9	9.0	3.0	0.0142	9.5	13.8	0.0068	3.0	97.0
120.00	17.3	8.5	2.5	0.0141	9.0	13.9	0.0048	2.5	97.5
240.00	18.1	8.5	2.5	0.0140	9.0	13.9	0.0034	2.5	97.5
480.00	18.6	8.0	2.0	0.0139	8.5	14.0	0.0024	2.0	98.0
1440.00	18.0	8.0	2.0	0.0140	8.5	14.0	0.0014	2.0	98.0

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	0.1	95.9	96.0	2.0	2.0	4.0

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0848	0.1238	0.1516	0.1574	0.1680	0.1781	0.1883	0.1989	0.2237	0.2313	0.2401	0.2560

Fineness Modulus	C_u	C_c
0.89	1.61	1.15

GRAIN SIZE DISTRIBUTION TEST DATA

2/22/2019

Client: ALS
Project: ALS
HS19020370
Project Number: 19.14.025
Location: HS19020370
Sample Number: 06-L7
USCS: SP

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Percent Retained
318.31	218.31	218.31	#10	218.31	100.0	0.0
			#20	218.47	99.8	0.2
			#40	218.68	99.6	0.4
			#60	247.99	70.3	29.7
			#100	311.17	7.1	92.9
			#200	313.74	4.6	95.4

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100.0
Weight of hydrometer sample =100
Hygroscopic moisture correction:
Moist weight and tare = 105.09
Dry weight and tare = 104.94
Tare weight = 31.33
Hygroscopic moisture = 0.2%
Table of composite correction values:

Temp., deg. C:	16.5	18.6
Comp. corr.:	-6.0	-6.0

Meniscus correction only = 0.5
Specific gravity of solids = 2.65
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 x Rm

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer	Percent Retained
1.00	16.5	9.5	3.5	0.0143	10.0	13.6	0.0527	3.5	96.5
2.00	16.5	9.5	3.5	0.0143	10.0	13.6	0.0373	3.5	96.5
4.00	16.5	9.5	3.5	0.0143	10.0	13.6	0.0264	3.5	96.5
8.00	16.5	9.5	3.5	0.0143	10.0	13.6	0.0186	3.5	96.5
15.00	16.6	9.5	3.5	0.0142	10.0	13.6	0.0136	3.5	96.5
30.00	16.7	8.5	2.5	0.0142	9.0	13.9	0.0097	2.5	97.5
60.00	17.0	8.5	2.5	0.0142	9.0	13.9	0.0068	2.5	97.5
120.00	17.4	8.5	2.5	0.0141	9.0	13.9	0.0048	2.5	97.5
240.00	18.2	8.0	2.0	0.0140	8.5	14.0	0.0034	2.0	98.0
480.00	18.6	7.5	1.5	0.0139	8.0	14.2	0.0024	1.5	98.5
1440.00	18.1	7.5	1.5	0.0140	8.0	14.2	0.0014	1.5	98.5

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	0.4	95.0	95.4	3.1	1.5	4.6

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0853	0.1551	0.1630	0.1703	0.1843	0.1983	0.2131	0.2295	0.2760	0.2942	0.3186	0.3555

Fineness Modulus	C_u	C_c
1.07	1.48	0.95

GRAIN SIZE DISTRIBUTION TEST DATA

2/22/2019

Client: ALS
Project: ALS
HS19020370
Project Number: 19.14.025
Location: HS19020370
Sample Number: 07-L8
USCS: SP

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Percent Retained
318.45	218.45	218.45	#10	218.45	100.0	0.0
			#20	218.50	99.9	0.1
			#40	218.62	99.8	0.2
			#60	256.94	61.5	38.5
			#100	311.84	6.6	93.4
			#200	314.21	4.2	95.8

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100.0
Weight of hydrometer sample =100
Hygroscopic moisture correction:
Moist weight and tare = 118.45
Dry weight and tare = 118.28
Tare weight = 30.56
Hygroscopic moisture = 0.2%
Table of composite correction values:

Temp., deg. C:	16.7	18.6
Comp. corr.:	-6.0	-6.0

Meniscus correction only = 0.5
Specific gravity of solids = 2.65
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer	Percent Retained
1.00	16.7	9.0	3.0	0.0142	9.5	13.8	0.0528	3.0	97.0
2.00	16.7	8.5	2.5	0.0142	9.0	13.9	0.0375	2.5	97.5
4.00	16.7	8.5	2.5	0.0142	9.0	13.9	0.0265	2.5	97.5
8.00	16.8	8.5	2.5	0.0142	9.0	13.9	0.0187	2.5	97.5
15.00	16.9	8.5	2.5	0.0142	9.0	13.9	0.0137	2.5	97.5
30.00	17.0	8.5	2.5	0.0142	9.0	13.9	0.0097	2.5	97.5
60.00	17.3	8.0	2.0	0.0141	8.5	14.0	0.0068	2.0	98.0
120.00	17.6	8.0	2.0	0.0141	8.5	14.0	0.0048	2.0	98.0
240.00	18.4	8.0	2.0	0.0139	8.5	14.0	0.0034	2.0	98.0
480.00	18.6	7.5	1.5	0.0139	8.0	14.2	0.0024	1.5	98.5
1440.00	18.2	7.5	1.5	0.0140	8.0	14.2	0.0014	1.5	98.5

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	0.2	95.6	95.8	2.7	1.5	4.2

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0934	0.1572	0.1666	0.1753	0.1918	0.2086	0.2265	0.2466	0.3023	0.3220	0.3462	0.3780

Fineness Modulus	C_u	C_c
1.14	1.57	0.95

GRAIN SIZE DISTRIBUTION TEST DATA

2/22/2019

Client: ALS
Project: ALS
HS19020370
Project Number: 19.14.025
Location: HS19020370
Sample Number: 08-L9
USCS: SP-SM

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Percent Retained
316.84	216.84	216.84	#10	216.84	100.0	0.0
			#20	217.07	99.8	0.2
			#40	217.44	99.4	0.6
			#60	238.72	78.1	21.9
			#100	307.81	9.0	91.0
			#200	310.09	6.7	93.3

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100.0
Weight of hydrometer sample =100
Hygroscopic moisture correction:
Moist weight and tare = 131.98
Dry weight and tare = 131.40
Tare weight = 31.94
Hygroscopic moisture = 0.6%
Table of composite correction values:

Temp., deg. C:	15.4	18.9
Comp. corr.:	-6.0	-6.0

Meniscus correction only = 0.5
Specific gravity of solids = 2.65
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer	Percent Retained
1.00	15.4	11.0	5.0	0.0145	11.5	13.3	0.0527	5.0	95.0
2.00	15.4	11.0	5.0	0.0145	11.5	13.3	0.0373	5.0	95.0
4.00	15.5	11.0	5.0	0.0145	11.5	13.3	0.0263	5.0	95.0
8.00	15.6	11.0	5.0	0.0144	11.5	13.3	0.0186	5.0	95.0
15.00	15.9	10.5	4.5	0.0144	11.0	13.4	0.0136	4.5	95.5
30.00	16.1	10.5	4.5	0.0143	11.0	13.4	0.0096	4.5	95.5
60.00	16.5	10.5	4.5	0.0143	11.0	13.4	0.0067	4.5	95.5
120.00	17.6	9.5	3.5	0.0141	10.0	13.6	0.0047	3.5	96.5
240.00	18.6	9.0	3.0	0.0139	9.5	13.8	0.0033	3.0	97.0
480.00	18.9	8.5	2.5	0.0138	9.0	13.9	0.0024	2.5	97.5
1440.00	18.6	8.5	2.5	0.0139	9.0	13.9	0.0014	2.5	97.5

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	0.6	92.7	93.3	4.2	2.5	6.7

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0181	0.1516	0.1590	0.1657	0.1783	0.1907	0.2036	0.2176	0.2545	0.2686	0.2877	0.3188

Fineness Modulus	C_u	C_c
0.99	1.44	0.96

GRAIN SIZE DISTRIBUTION TEST DATA

2/22/2019

Client: ALS
Project: ALS
HS19020370
Project Number: 19.14.025
Location: HS19020370
Sample Number: 09-L10
USCS: SP-SM

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Percent Retained
288.25	188.25	188.25	#10	188.26	100.0	0.0
			#20	188.33	99.9	0.1
			#40	188.52	99.7	0.3
			#60	230.17	58.1	41.9
			#100	279.35	8.9	91.1
			#200	280.40	7.9	92.1

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100.0
Weight of hydrometer sample =100
Hygroscopic moisture correction:
Moist weight and tare = 142.83
Dry weight and tare = 142.50
Tare weight = 31.28
Hygroscopic moisture = 0.3%
Table of composite correction values:

Temp., deg. C:	15.3	19.0
Comp. corr.:	-6.0	-6.0

Meniscus correction only = 0.5
Specific gravity of solids = 2.65
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 x Rm

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer	Percent Retained
1.00	15.3	10.5	4.5	0.0145	11.0	13.4	0.0530	4.5	95.5
2.00	15.3	10.0	4.0	0.0145	10.5	13.5	0.0377	4.0	96.0
4.00	15.4	10.0	4.0	0.0145	10.5	13.5	0.0266	4.0	96.0
8.00	15.6	10.0	4.0	0.0144	10.5	13.5	0.0188	4.0	96.0
15.00	15.7	10.0	4.0	0.0144	10.5	13.5	0.0137	4.0	96.0
30.00	16.2	10.0	4.0	0.0143	10.5	13.5	0.0096	4.0	96.0
60.00	16.6	10.0	4.0	0.0142	10.5	13.5	0.0068	4.0	96.0
120.00	17.4	9.0	3.0	0.0141	9.5	13.8	0.0048	3.0	97.0
240.00	18.8	9.0	3.0	0.0139	9.5	13.8	0.0033	3.0	97.0
480.00	19.0	8.0	2.0	0.0138	8.5	14.0	0.0024	2.0	98.0
1440.00	18.6	8.0	2.0	0.0139	8.5	14.0	0.0014	2.0	98.0

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
					0.3	91.8		5.9	2.0	7.9

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0572	0.1530	0.1646	0.1748	0.1937	0.2125	0.2323	0.2545	0.3126	0.3321	0.3554	0.3849

Fineness Modulus	C_u	C_c
1.15	1.66	0.96

GRAIN SIZE DISTRIBUTION TEST DATA

2/22/2019

Client: ALS
Project: ALS
HS19020370
Project Number: 19.14.025
Location: HS19020370
Sample Number: 010-L11
USCS: SP-SM

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Percent Retained
316.94	216.94	216.94	#10	216.94	100.0	0.0
			#20	218.91	98.0	2.0
			#40	220.84	96.1	3.9
			#60	244.40	72.5	27.5
			#100	303.96	13.0	87.0
			#200	310.45	6.5	93.5

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100.0
Weight of hydrometer sample =100
Hygroscopic moisture correction:
Moist weight and tare = 88.53
Dry weight and tare = 88.38
Tare weight = 30.49
Hygroscopic moisture = 0.3%
Table of composite correction values:

Temp., deg. C:	15.7	19.0
Comp. corr.:	-6.0	-6.0

Meniscus correction only = 0.5
Specific gravity of solids = 2.65
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer	Percent Retained
1.00	15.7	12.0	6.0	0.0144	12.5	13.0	0.0520	6.0	94.0
2.00	15.7	11.0	5.0	0.0144	11.5	13.3	0.0371	5.0	95.0
4.00	15.8	11.0	5.0	0.0144	11.5	13.3	0.0262	5.0	95.0
8.00	15.9	11.0	5.0	0.0144	11.5	13.3	0.0185	5.0	95.0
15.00	16.2	11.0	5.0	0.0143	11.5	13.3	0.0135	5.0	95.0
30.00	16.2	10.0	4.0	0.0143	10.5	13.5	0.0096	4.0	96.0
60.00	16.9	10.0	4.0	0.0142	10.5	13.5	0.0067	4.0	96.0
120.00	17.7	10.0	4.0	0.0140	10.5	13.5	0.0047	4.0	96.0
240.00	18.9	9.5	3.5	0.0138	10.0	13.6	0.0033	3.5	96.5
480.00	19.0	9.5	3.5	0.0138	10.0	13.6	0.0023	3.5	96.5
1440.00	18.7	9.0	3.0	0.0139	9.5	13.8	0.0014	3.0	97.0

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	3.9	89.6	93.5	3.0	3.5	6.5

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0134	0.1190	0.1536	0.1618	0.1767	0.1913	0.2065	0.2235	0.2724	0.2936	0.3253	0.3926

Fineness Modulus	C_u	C_c
1.05	1.88	1.17

GRAIN SIZE DISTRIBUTION TEST DATA

2/22/2019

Client: ALS
Project: ALS
HS19020370
Project Number: 19.14.025
Location: HS19020370
Sample Number: 011-L12
USCS: SP-SM

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Percent Retained
447.93	264.61	264.61	1.5"	264.61	100.0	0.0
			3/4"	266.87	98.8	1.2
			#4	303.29	78.9	21.1
267.20	217.20	217.20	#10	217.21	78.9	21.1
			#20	218.46	76.9	23.1
			#40	219.49	75.3	24.7
			#60	220.58	73.6	26.4
			#100	252.18	23.7	76.3
			#200	261.80	8.5	91.5

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 78.9
Weight of hydrometer sample =50
Hygroscopic moisture correction:
Moist weight and tare = 103.97
Dry weight and tare = 103.82
Tare weight = 30.57
Hygroscopic moisture = 0.2%
Table of composite correction values:

Temp., deg. C:	16.6	19.0
Comp. corr.:	-6.0	-6.0

Meniscus correction only = 0.5
Specific gravity of solids = 2.65
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer	Percent Retained
1.00	16.6	10.5	4.5	0.0142	11.0	13.4	0.0521	7.1	92.9
2.00	16.6	10.0	4.0	0.0142	10.5	13.5	0.0370	6.3	93.7
4.00	16.7	10.0	4.0	0.0142	10.5	13.5	0.0262	6.3	93.7
8.00	16.8	10.0	4.0	0.0142	10.5	13.5	0.0185	6.3	93.7
15.00	16.9	10.0	4.0	0.0142	10.5	13.5	0.0135	6.3	93.7
30.00	17.1	10.0	4.0	0.0142	10.5	13.5	0.0095	6.3	93.7
60.00	17.4	9.5	3.5	0.0141	10.0	13.6	0.0067	5.5	94.5
120.00	17.9	9.0	3.0	0.0140	9.5	13.8	0.0047	4.7	95.3
240.00	18.9	8.5	2.5	0.0138	9.0	13.9	0.0033	4.0	96.0
480.00	19.0	8.0	2.0	0.0138	8.5	14.0	0.0024	3.2	96.8
1440.00	18.7	8.0	2.0	0.0139	8.5	14.0	0.0014	3.2	96.8

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	1.2	19.9	21.1	0.0	3.6	66.8	70.4	5.3	3.2	8.5

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0054	0.0847	0.1106	0.1335	0.1609	0.1770	0.1937	0.2126	5.3684	7.6788	10.2525	13.8755

Fineness Modulus	C_u	C_c
2.03	2.51	1.44

GRAIN SIZE DISTRIBUTION TEST DATA

2/22/2019

Client: ALS
Project: ALS
HS19020370
Project Number: 19.14.025
Location: HS19020370
Sample Number: 012-L13
USCS: GP

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Percent Retained
474.04	272.13	272.13	3/4	272.13	100.0	0.0
			#4	392.54	40.4	59.6
268.55	218.55	218.55	#10	218.55	40.4	59.6
			#20	224.01	36.0	64.0
			#40	226.87	33.6	66.4
			#60	229.54	31.5	68.5
			#100	251.50	13.8	86.2
			#200	262.50	4.9	95.1

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 40.4
Weight of hydrometer sample =50
Hygroscopic moisture correction:
Moist weight and tare = 71.95
Dry weight and tare = 71.81
Tare weight = 30.48
Hygroscopic moisture = 0.3%
Table of composite correction values:

Temp., deg. C:	17.0	19.0
Comp. corr.:	-6.0	-6.0

Meniscus correction only = 0.5
Specific gravity of solids = 2.65
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer	Percent Retained
1.00	17.0	13.0	7.0	0.0142	13.5	12.7	0.0506	5.7	94.3
2.00	17.0	12.0	6.0	0.0142	12.5	13.0	0.0361	4.9	95.1
4.00	17.2	11.5	5.5	0.0141	12.0	13.1	0.0256	4.5	95.5
8.00	17.2	11.5	5.5	0.0141	12.0	13.1	0.0181	4.5	95.5
15.00	17.3	11.5	5.5	0.0141	12.0	13.1	0.0132	4.5	95.5
30.00	17.4	11.5	5.5	0.0141	12.0	13.1	0.0093	4.5	95.5
60.00	17.6	10.5	4.5	0.0141	11.0	13.4	0.0066	3.6	96.4
120.00	18.2	10.5	4.5	0.0140	11.0	13.4	0.0047	3.6	96.4
240.00	19.0	9.5	3.5	0.0138	10.0	13.6	0.0033	2.8	97.2
480.00	18.5	9.5	3.5	0.0139	10.0	13.6	0.0023	2.8	97.2
1440.00	18.8	9.5	3.5	0.0139	10.0	13.6	0.0013	2.8	97.2

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	59.6	59.6	0.0	6.8	28.7	35.5	2.1	2.8	4.9

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0773	0.1238	0.1557	0.1781	0.2355	1.8837	6.9815	8.9680	13.3616	14.6291	15.9895	17.4574

Fineness Modulus	C_u	C_c
4.38	72.42	0.05

GRAIN SIZE DISTRIBUTION TEST DATA

2/22/2019

Client: ALS
Project: ALS
HS19020370
Project Number: 19.14.025
Location: HS19020370
Sample Number: 013-L14
USCS: SC

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Percent Retained
282.98	232.98	232.98	#10	233.00	100.0	0.0
			#20	233.98	98.0	2.0
			#40	234.59	96.8	3.2
			#60	234.97	96.0	4.0
			#100	262.09	41.8	58.2
			#200	273.86	18.2	81.8

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100.0
Weight of hydrometer sample =50
Hygroscopic moisture correction:
Moist weight and tare = 131.96
Dry weight and tare = 131.48
Tare weight = 30.88
Hygroscopic moisture = 0.5%
Table of composite correction values:

Temp., deg. C:	17.3	19.2
Comp. corr.:	-6.0	-6.0

Meniscus correction only = 0.5
Specific gravity of solids = 2.65
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer	Percent Retained
1.00	17.3	15.0	9.0	0.0141	15.5	12.2	0.0493	18.1	81.9
2.00	17.3	14.5	8.5	0.0141	15.0	12.3	0.0351	17.1	82.9
4.00	17.4	14.5	8.5	0.0141	15.0	12.3	0.0248	17.1	82.9
8.00	17.4	14.5	8.5	0.0141	15.0	12.3	0.0175	17.1	82.9
15.00	17.5	14.5	8.5	0.0141	15.0	12.3	0.0128	17.1	82.9
30.00	17.6	14.0	8.0	0.0141	14.5	12.5	0.0091	16.1	83.9
60.00	17.9	13.5	7.5	0.0140	14.0	12.6	0.0064	15.1	84.9
120.00	18.3	12.5	6.5	0.0139	13.0	12.9	0.0046	13.1	86.9
240.00	19.2	11.5	5.5	0.0138	12.0	13.1	0.0032	11.0	89.0
480.00	18.6	11.5	5.5	0.0139	12.0	13.1	0.0023	11.0	89.0
1440.00	18.9	11.0	5.0	0.0138	11.5	13.3	0.0013	10.0	90.0

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
					3.2	78.6		7.3	10.9	18.2

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
		0.0063	0.0973	0.1287	0.1471	0.1623	0.1768	0.2092	0.2192	0.2310	0.2461

Fineness Modulus
0.66

GRAIN SIZE DISTRIBUTION TEST DATA

2/22/2019

Client: ALS
Project: ALS
HS19020370
Project Number: 19.14.025
Location: HS19020370
Sample Number: 014-L15
USCS: ML

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Percent Retained
318.20	218.20	218.20	#10	218.21	100.0	0.0
			#20	218.22	100.0	0.0
			#40	218.28	99.9	0.1
			#60	218.66	99.5	0.5
			#100	251.11	67.1	32.9
			#200	261.69	56.5	43.5

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100.0
Weight of hydrometer sample =100
Hygroscopic moisture correction:
Moist weight and tare = 168.86
Dry weight and tare = 168.47
Tare weight = 31.27
Hygroscopic moisture = 0.3%
Table of composite correction values:

Temp., deg. C:	17.4	19.2
Comp. corr.:	-6.0	-6.0

Meniscus correction only = 0.5
Specific gravity of solids = 2.65
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer	Percent Retained
1.00	17.8	12.5	6.5	0.0140	13.0	12.9	0.0503	6.5	93.5
2.00	17.8	12.0	6.0	0.0140	12.5	13.0	0.0358	6.0	94.0
4.00	17.5	11.5	5.5	0.0141	12.0	13.1	0.0255	5.5	94.5
8.00	17.6	11.5	5.5	0.0141	12.0	13.1	0.0180	5.5	94.5
15.00	17.4	11.5	5.5	0.0141	12.0	13.1	0.0132	5.5	94.5
30.00	17.8	11.0	5.0	0.0140	11.5	13.3	0.0093	5.0	95.0
60.00	18.1	10.5	4.5	0.0140	11.0	13.4	0.0066	4.5	95.5
120.00	18.4	10.5	4.5	0.0139	11.0	13.4	0.0046	4.5	95.5
240.00	19.2	9.5	3.5	0.0138	10.0	13.6	0.0033	3.5	96.5
480.00	18.8	9.5	3.5	0.0139	10.0	13.6	0.0023	3.5	96.5
1440.00	18.9	9.0	3.0	0.0138	9.5	13.8	0.0014	3.0	97.0

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
					0.1	43.4		53.1	3.4	56.5

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0093	0.0525	0.0550	0.0572	0.0614	0.0658	0.0708	0.0943	0.1875	0.2002	0.2140	0.2301

Fineness Modulus	C_u	C_c
0.33	1.80	0.76

ATTACHMENT 4

INVERTEBRATE PHOTOLOG

PHOTO 1:

Magelona riojai, a polychaete worm belonging to the Family Magelonidae, found in benthic samples from L-1, L-7, L-8, and L-9.

PHOTO 2:

Onuphis eremita oculata, a polychaete worm belonging to the Family Onuphidae, found in benthic samples from L-9 and L-11.

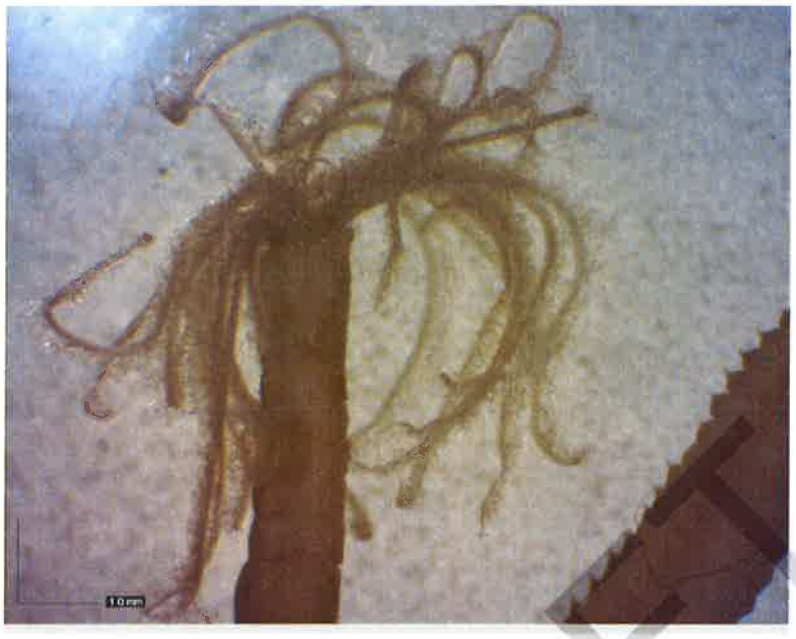


PHOTO 3:

Laonome sp., a polychaete worm belonging to the Family Sabellidae, found in benthic samples from L-2 and L-4.

PHOTO 4:

Astyris lunata, a gastropod mollusc belonging to the Family Columbellidae, found in the benthic sample from L-6.

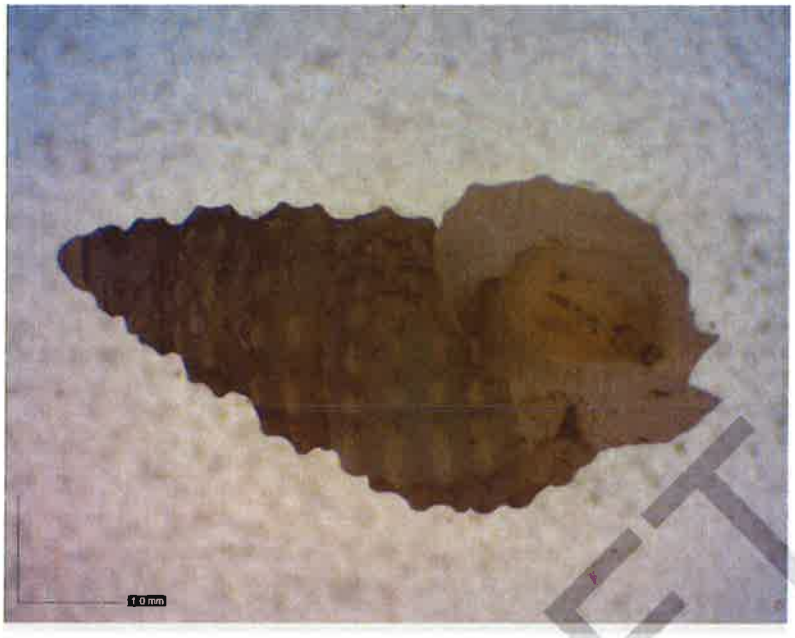


PHOTO 5:

Nassarius acutus, a gastropod mollusc belonging to the Family Nassariidae, found in the benthic sample from L-15.

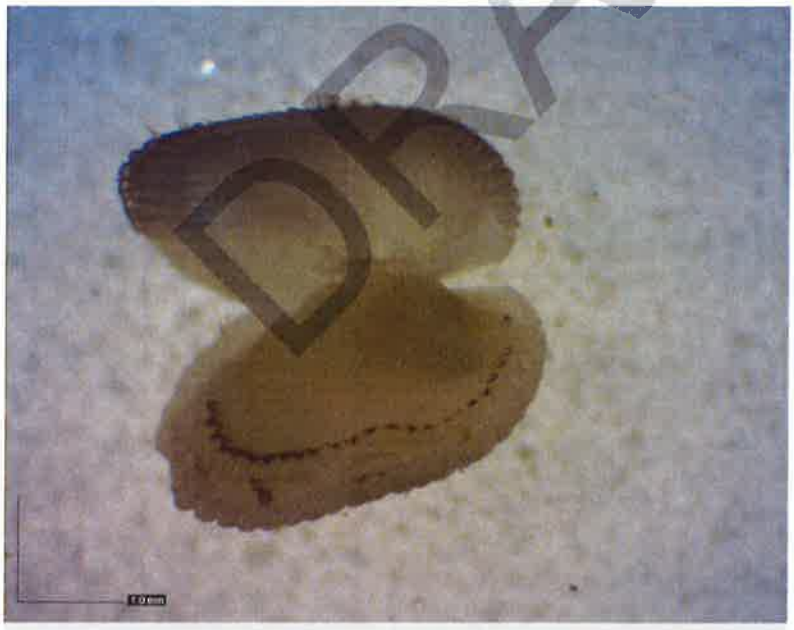


PHOTO 6:

Anadara transversa, a bivalve mollusk belonging to the Family Arcidae, found in benthic samples from L-6, L-10, L-13, and L-14.

PHOTO 7:

Petricolaria pholadiformis, a bivalve mollusc belonging to the Family Petricolidae, found in benthic samples from L-4 and L-12.

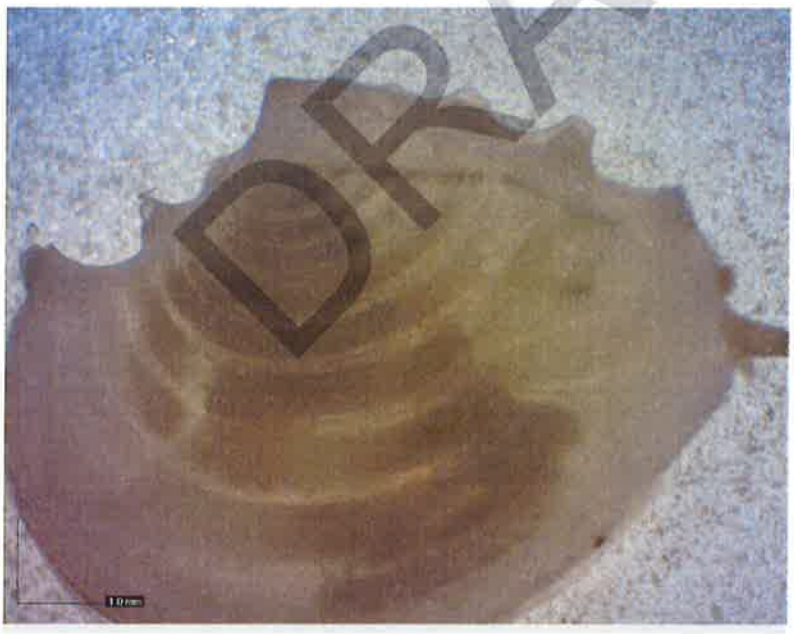


PHOTO 8:

Tellidora cristata, a bivalve mollusc belonging to the Family Tellinidae, found in the benthic sample from L-12.

PHOTO 9:

Oxyurostylis lecroyae, a cumacean crustacean belonging to the Family Diastylidae, found in benthic samples from L-2, L-5, and L-15.

PHOTO 10:

Caprella equilibra, an amphipod crustacean belonging to the Family Caprellidae, found in benthic samples from L-4 and L-6 and the plankton sample from P-1.

PHOTO 11:

Monocorophium tuberculatum, an amphipod crustacean belonging to the Family Corophiidae, found in benthic samples from L-2 and L-6.

PHOTO 12:

Elasmopus levis, an amphipod crustacean belonging to the Family Melitidae, found in the benthic sample from L-6.

PHOTO 13:

Argissa hamatipes, an amphipod crustacean belonging to the Family Argissidae, found in the benthic sample from L-2.

PHOTO 14:

Eobrolgus spinosus, an amphipod crustacean belonging to the Family Phoxocephalidae, found in the benthic sample from L-6.

PHOTO 15:

Ericthonius brasiliensis, an amphipod crustacean belonging to the Family Ischyroceridae, found in the benthic sample from L-6.

PHOTO 16:

Eudevenopus honduranus, an amphipod crustacean belonging to the Family Platyischnopidae, found in the benthic sample from L-5.

PHOTO 17:

Protohaustorius cf. *bousfieldi*, an amphipod crustacean found in benthic samples from L-5, L-7, and L-8.

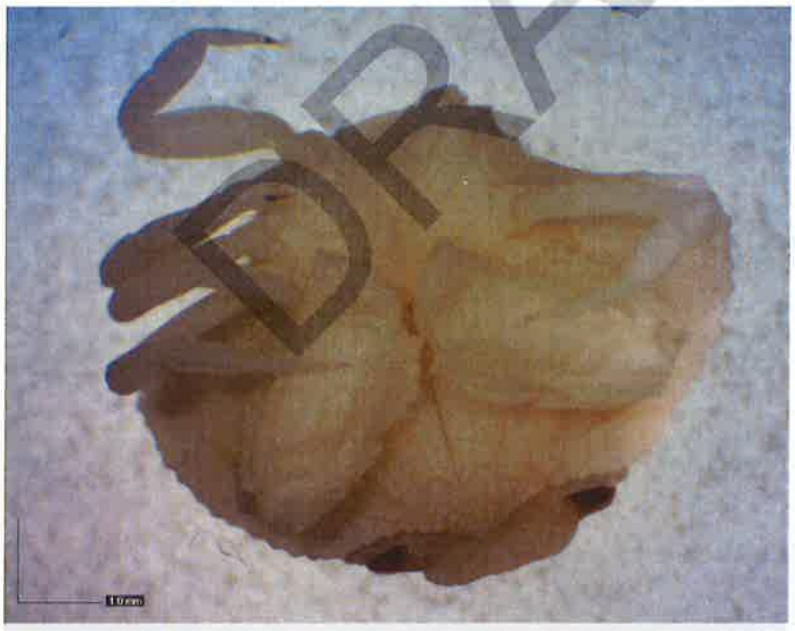


PHOTO 18:

Hepatus sp., a decapod crustacean belonging to the Family Hepatidae, found in the benthic sample from L-4.

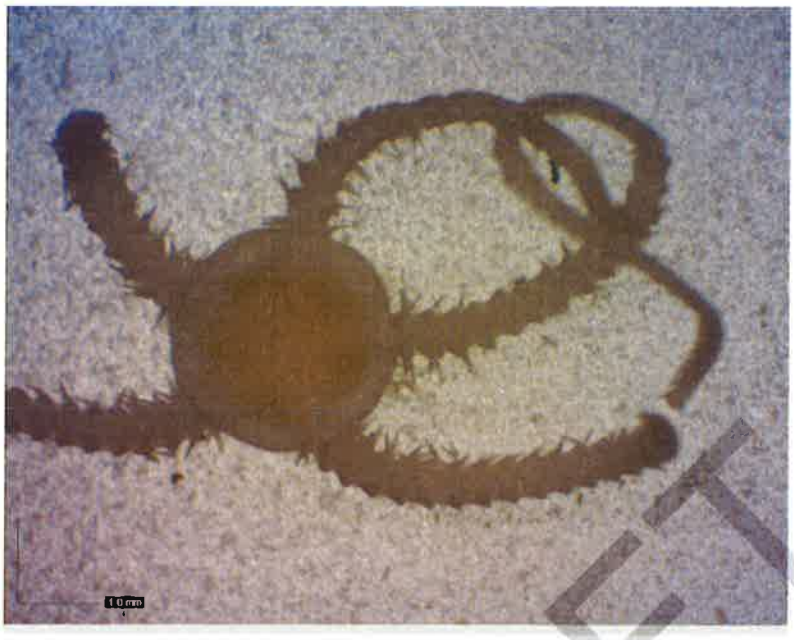


PHOTO 19:

Amphiodia atra, an ophiuroid echinoderm belonging to the Family Amphiuridae, found in the benthic sample from L-12.

PHOTO 20:

Hemipholis cordifera, an ophiuroid echinoderm belonging to the Family Ophiactidae, found in the benthic sample from L-6.

PHOTO 21:

Amathia alternata, a colonial bryozoan belonging to the Family Vesiculariidae, found in benthic samples from L-2, L-4, L-6, L-10, L-14, and L-15.

PHOTO 22:

Bugula neritina, a colonial bryozoan belonging to the Family Bugulidae, found in benthic samples from L-2, L-3, L-10, L-13, L-14, and L-15.

APPENDICES

APPENDIX 1
PHYLOGENETIC TAXONOMIC LIST FOR BENTHIC SAMPLES
PORT OF CORPUS CHRISTI AUTHORITY
PROJECT TURNPIKE

Species ID	Phylum	Subphylum	Class	Subclass	Order	Family	Taxa	Species Notes	Reference
000000000010	Porifera						Porifera spp.	Colonial; present	
010200000000	Cnidaria		Anthozoa				Anthozoa spp.		
010303010100	Cnidaria		Hydrozoa	Hydroidolina	Anthoathecata	Eudendriidae	*Eudendrium* spp.	Colonial; present	Boullion & Boero, 2000; Felder & Camp, 2009
010303030100	Cnidaria		Hydrozoa	Hydroidolina	Anthoathecata	Tubulariidae	*Ectopleura* spp.	Colonial; present	Boullion & Boero, 2000; Felder & Camp, 2009
010304000000	Cnidaria		Hydrozoa	Hydroidolina	Leptothecata		Leptothecata spp.	Colonial; present	Boullion & Boero, 2000; Felder & Camp, 2009
010304010000	Cnidaria		Hydrozoa	Hydroidolina	Leptothecata	Campanulariidae	Campanulariidae spp.	Colonial; present	Boullion & Boero, 2000; Felder & Camp, 2009
010304010101	Cnidaria		Hydrozoa	Hydroidolina	Leptothecata	Campanulariidae	*Laomedea* cf. *flexuosa*	Colonial; present	Boullion & Boero, 2000; Felder & Camp, 2009
010304040100	Cnidaria		Hydrozoa	Hydroidolina	Leptothecata	Lovenellidae	*Lovenella* spp.	Colonial; present	
020000000000	Platyhelminthes						Platyhelminthes spp.		
030000000000	Nemertea						Nemertea spp.		
030101000000	Nemertea		Anopla		Palaeonemertea		Palaeonemertea spp.		
030101010101	Nemertea		Anopla		Palaeonemertea	Tubulanidae	*Tubulanus pellucidus*		
030102000000	Nemertea		Anopla		Heteronemertea		Heteronemertea spp.		
030201030101	Nemertea		Enopla		Hoplonemertea	Amphiporidae	*Zygonemertes virescens*		
040101010100	Annelida		Polychaeta	Sedentaria		Orbiniidae	*Leitoscoloplos* spp.		
040101010200	Annelida		Polychaeta	Sedentaria		Orbiniidae	*Scoloplos* spp.		
040101010203	Annelida		Polychaeta	Sedentaria		Orbiniidae	*Scoloplos capensis*		
040101020202	Annelida		Polychaeta	Sedentaria		Paraonidae	*Aricidea (Acmira) philbinae*		
040104010100	Annelida		Polychaeta	Sedentaria		Cossuridae	*Cossura* spp.		
040105020201	Annelida		Polychaeta	Sedentaria	Spionida	Spionidae	*Minuspio perkinsi*	=Prionospio perkinsi	Delgado-Blas & Salazar-Silva, 2011
040105020204	Annelida		Polychaeta	Sedentaria	Spionida	Spionidae	*Prionospio cristata*		
040105020400	Annelida		Polychaeta	Sedentaria	Spionida	Spionidae	*Streblospio* spp.		Rice & Levin, 1998
040105020501	Annelida		Polychaeta	Sedentaria	Spionida	Spionidae	*Paraprionospio yokoyamai*	=Paraprionospio pinnata/alata	Delgado-Blas & Carrera-Parra, 2018; Yokoyama, 2007; Delgado-Blas, 2004
040105020601	Annelida		Polychaeta	Sedentaria	Spionida	Spionidae	*Dipolydora socialis*	=Polydora socialis	Blake, 1996
040105020602	Annelida		Polychaeta	Sedentaria	Spionida	Spionidae	*Polydora websteri*		
040105020603	Annelida		Polychaeta	Sedentaria	Spionida	Spionidae	*Polydora cornuta* sp. complex	=Polydora cornuta/ligni	Blake & Maciolek, 1987; Rice et al. 2008
040105020607	Annelida		Polychaeta	Sedentaria	Spionida	Spionidae	*Polydora aggregata*		
040105020701	Annelida		Polychaeta	Sedentaria	Spionida	Spionidae	*Apoprionospio pygmaea*		Foster, 1969
040105021001	Annelida		Polychaeta	Sedentaria	Spionida	Spionidae	*Spiophanes bombyx*		
040105021301	Annelida		Polychaeta	Sedentaria	Spionida	Spionidae	*Boccardiella hamata*		
040105030101	Annelida		Polychaeta incertae sedis			Magelonidae	*Magelona pettiboneae*		
040105030102	Annelida		Polychaeta incertae sedis			Magelonidae	*Meredithia uebelackerae*	=Magelona sp. H (of Uebelacker & Jones, 1984)	Hernandez-Alcantara & Solis-Weiss, 2000
040105030104	Annelida		Polychaeta incertae sedis			Magelonidae	*Magelona riojai*		
040105070101	Annelida		Polychaeta	Sedentaria		Chaetopteridae	*Spiochaetopterus costarum* sp. complex	=Spiochaetopterus costarum	Bhaud et al., 2003; Bhaud, 2003; Bhaud & Petti, 2001
040105080300	Annelida		Polychaeta	Sedentaria	Terebellida	Cirratulidae	*Cirriformia* spp.		

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040105080400	Annelida		Polychaeta	Sedentaria	Terebellida	Cirratulidae	*Aphelochaeta* spp.		
040105080601	Annelida		Polychaeta	Sedentaria	Terebellida	Cirratulidae	*Dodecaceria* sp. A		of Wolf, 1984
040106010300	Annelida		Polychaeta	Sedentaria		Capitellidae	*Mediomastus* spp.		
040106010301	Annelida		Polychaeta	Sedentaria		Capitellidae	*Mediomastus californiensis*		
040106010302	Annelida		Polychaeta	Sedentaria		Capitellidae	*Mediomastus ambiseta*		
040106010400	Annelida		Polychaeta	Sedentaria		Capitellidae	*Notomastus* spp.		
040106020101	Annelida		Polychaeta	Sedentaria		Arenicolidae	*Arenicola cristata*		
040107010102	Annelida		Polychaeta	Sedentaria		Ophelidae	*Armandia agilis*		
040108010102	Annelida		Polychaeta	Errantia	Phyllodocida	Phyllodocidae	*Eteone foliosa*	=Eteone lactea	Wilson, 1988
040108100100	Annelida		Polychaeta	Errantia	Phyllodocida	Sigalionidae	*Sthenelais* spp.		
040108140101	Annelida		Polychaeta	Errantia	Phyllodocida	Hesionidae	*Podarkeopsis levifuscina*		
040108150102	Annelida		Polychaeta	Errantia	Phyllodocida	Pilargidae	*Sigambra tentaculata*		
040108150302	Annelida		Polychaeta	Errantia	Phyllodocida	Pilargidae	*Ancistrosyllis papillosa*		
040108160100	Annelida		Polychaeta	Errantia	Phyllodocida	Syllidae	*Syllis (Typosyllis)* spp.	Subgenus	
040108160103	Annelida		Polychaeta	Errantia	Phyllodocida	Syllidae	*Syllis (Typosyllis) alosae*		
040108160201	Annelida		Polychaeta	Errantia	Phyllodocida	Syllidae	*Exogone dispar*		
040108160301	Annelida		Polychaeta	Errantia	Phyllodocida	Syllidae	*Syllis (Syllis) gracilis* sp. complex		Cognetti & Maltagliati, 2000
040108160701	Annelida		Polychaeta	Errantia	Phyllodocida	Syllidae	*Salvatoria clavata*	=Brania/Grubeosyllis clavata	San Martin, 1991, 2003
040108180201	Annelida		Polychaeta	Errantia	Phyllodocida	Nereididae	*Neanthes micromma*		
040108180202	Annelida		Polychaeta	Errantia	Phyllodocida	Nereididae	*Alitta succinea*	=Neanthes succinea	Bakken, 2004; Bakken & Wilson, 2005
040108180400	Annelida		Polychaeta	Errantia	Phyllodocida	Nereididae	*Nereis* spp.		
040108180401	Annelida		Polychaeta	Errantia	Phyllodocida	Nereididae	*Nereis falsa*		
040108200101	Annelida		Polychaeta	Errantia	Phyllodocida	Glyceridae	*Glycera americana*		
040108210000	Annelida		Polychaeta	Errantia	Phyllodocida	Goniadidae	Goniadidae spp.		
040108210101	Annelida		Polychaeta	Errantia	Phyllodocida	Goniadidae	*Glycinde multidens*	=Glycinde solitaria	Boggemann, 2005
040108240103	Annelida		Polychaeta	Errantia	Phyllodocida	Nephtyidae	*Nephtys cryptomma*		
040108240201	Annelida		Polychaeta	Errantia	Phyllodocida	Nephtyidae	*Aglaophamus verrilli*		
040111010101	Annelida		Polychaeta	Errantia	Eunicida	Onuphidae	*Diopatra cuprea*		
040111010401	Annelida		Polychaeta	Errantia	Eunicida	Onuphidae	*Onuphis eremita oculata*	Subspecies	
040111030201	Annelida		Polychaeta	Errantia	Eunicida	Lumbrineridae	*Scoletoma verrilli*	=Lumbrineris verrilli	Carrera-Parra, 2001
040113010000	Annelida		Polychaeta	Sedentaria	Sabellida	Oweniidae	Oweniidae spp.		
040113010101	Annelida		Polychaeta	Sedentaria	Sabellida	Oweniidae	*Owenia* sp. A		of Milligan, 1984
040116030003	Annelida		Polychaeta	Sedentaria	Terebellida	Ampharetidae	Ampharetidae sp. A	=Sabellides sp. A (of Uebelacker, 1984)	of Davenport, pers. comm.
040116030201	Annelida		Polychaeta	Sedentaria	Terebellida	Ampharetidae	*Melinna maculata*		
040116030301	Annelida		Polychaeta	Sedentaria	Terebellida	Ampharetidae	*Isolda pulchella*		
040117010001	Annelida		Polychaeta	Sedentaria	Sabellida	Sabellidae	Sabellinae spp.	Subfamily	
040117010303	Annelida		Polychaeta	Sedentaria	Sabellida	Sabellidae	*Acromegalomma bioculatum*	=Megalomma bioculatum	Gil & Nishi, 2017
040117011200	Annelida		Polychaeta	Sedentaria	Sabellida	Sabellidae	*Laonome* spp.		
040117011300	Annelida		Polychaeta	Sedentaria	Sabellida	Sabellidae	*Chone* spp.		

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040117020000	Annelida		Polychaeta	Sedentaria	Sabellida	Serpulidae	Serpulidae spp.		
040117020002	Annelida		Polychaeta	Sedentaria	Sabellida	Serpulidae	Pileolariini spp.	Tribe	
040117020004	Annelida		Polychaeta	Sedentaria	Sabellida	Serpulidae	Januini spp.	Tribe	
040117020100	Annelida		Polychaeta	Sedentaria	Sabellida	Serpulidae	*Hydroides* spp.		
040117020101	Annelida		Polychaeta	Sedentaria	Sabellida	Serpulidae	*Hydroides dianthus*		
040201020000	Annelida		Clitellata	Oligochaeta	Tubificida	Naididae	Naididae spp.	=Tubificidae spp.	Erseus et al., 2008
040201020003	Annelida		Clitellata	Oligochaeta	Tubificida	Naididae	Tubificinae spp.	Subfamily	
040201020401	Annelida		Clitellata	Oligochaeta	Tubificida	Naididae	*Tubificoides brownae*		
050100000001	Mollusca		Gastropoda	Heterobranchia			Heterobranchia spp.	Subclass	
050103020101	Mollusca		Gastropoda	Caenogastropoda	Littorinimorpha	Caecidae	*Caecum pulchellum*		
050108010000	Mollusca		Gastropoda	Caenogastropoda	Littorinimorpha	Calyptraeidae	Calyptraeidae spp.		
050108010103	Mollusca		Gastropoda	Caenogastropoda	Littorinimorpha	Calyptraeidae	*Crepidula depressa*	=Crepidula plana	Collin, 2000
050111010000	Mollusca		Gastropoda	Caenogastropoda	Littorinimorpha	Naticidae	Naticidae spp.		
050111010202	Mollusca		Gastropoda	Caenogastropoda	Littorinimorpha	Naticidae	*Neverita delessertiana*		
050116020000	Mollusca		Gastropoda	Caenogastropoda	Neogastropoda	Buccinidae	Buccinidae spp.		
050116030101	Mollusca		Gastropoda	Caenogastropoda	Neogastropoda	Columbellidae	*Astyris lunata*		
050116030202	Mollusca		Gastropoda	Caenogastropoda	Neogastropoda	Columbellidae	*Parvanachis ostreicola*		
050116040103	Mollusca		Gastropoda	Caenogastropoda	Neogastropoda	Nassariidae	*Nassarius acutus*		
050120010501	Mollusca		Gastropoda	Heterobranchia		Pyramidellidae	*Cyclostremella humilis*		
050120010603	Mollusca		Gastropoda	Heterobranchia		Pyramidellidae	*Eulimastoma harbisonae*		
050200000000	Mollusca		Bivalvia				Bivalvia spp.		
050202010101	Mollusca		Bivalvia	Pteriomorphia	Arcoida	Arcidae	*Anadara transversa*		
050204010101	Mollusca		Bivalvia	Pteriomorphia	Mytiloida	Mytilidae	*Arcuatula papyria*	=Amygdalum papyrium	
050211010101	Mollusca		Bivalvia	Heterodonta	Veneroida	Lucinidae	*Parvilucina crenella*	=Parvilucina multilineata	Mikkelsen & Bieler, 2008
050216010101	Mollusca		Bivalvia	Heterodonta	Veneroida	Mactridae	*Mulinia lateralis*		
050218010000	Mollusca		Bivalvia	Heterodonta	Veneroida	Tellinidae	Tellinidae spp.		
050218010202	Mollusca		Bivalvia	Heterodonta	Veneroida	Tellinidae	*Ameritella versicolor*	=Angulus versicolor; =Tellina versicolor	Mikkelsen & Bieler, 2008; Huber et al., 2015
050218010401	Mollusca		Bivalvia	Heterodonta	Veneroida	Tellinidae	*Tellidora cristata*		
050218010701	Mollusca		Bivalvia	Heterodonta	Veneroida	Tellinidae	*Macoploma tenta*	=Macoma tenta	
050218011001	Mollusca		Bivalvia	Heterodonta	Veneroida	Tellinidae	*Pseudomacalia antillarum*	=Macoma pseudomera	
050220020101	Mollusca		Bivalvia	Heterodonta	Veneroida	Petricolidae	*Petricolaria pholadiformis*		
050220050000	Mollusca		Bivalvia	Heterodonta	Veneroida	Ungulinidae	Ungulinidae spp.		
050221020101	Mollusca		Bivalvia	Heterodonta	Myoida	Myidae	*Sphenia fragilis*	=Sphenia antillensis	Mikkelsen & Bieler, 2008
050221040401	Mollusca		Bivalvia	Heterodonta	Myoida	Pholadidae	*Diplothyra curta*	=Diplothyra smithii	Coan & Valentich-Scott, 2012
060101010000	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Tanaidacea	Leptocheliidae	Leptocheliidae spp.		
060102010100	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Cumacea	Diastylidae	*Oxyurostylis* spp.		
060102010102	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Cumacea	Diastylidae	*Oxyurostylis lecroyae*		
060103010201	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Isopoda	Hyssuridae	*Xenanthura brevitelson*		
060104020201	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Melitidae	*Elasmopus levis*		

APPENDIX 1
PHYLOGENETIC TAXONOMIC LIST FOR BENTHIC SAMPLES
PORT OF CORPUS CHRISTI AUTHORITY
PROJECT TURNPIKE

Species ID	Phylum	Subphylum	Class	Subclass	Order	Family	Taxa	Species Notes	Reference
060104040101	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Bateidae	*Batea catharinensis*		
060104050201	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Haustoriidae	*Protohaustorius* cf. *bousfieldi*		
060104060101	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Argissidae	*Argissa hamatipes*		
060104070301	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Oedicerotidae	*Americhelidium* sp. A		of Lecroy, 2000
060104100101	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Phoxocephalidae	*Eobrolgus spinosus*		
060104120101	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Ampeliscidae	*Ampelisca abdita*		
060104150100	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Ampithoidae	*Cymadusa* spp.		
060104170001	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Corophiidae	Corophiidae spp.		
060104170201	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Ischyroceridae	*Ericthonius brasiliensis*		
060104170302	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Ischyroceridae	*Cerapus ryanadamsi*	=Cerapus sp. C (of LeCroy, 2007)	Drumm, 2018
060104170400	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Corophiidae	*Monocorophium* spp.		
060104170401	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Corophiidae	*Monocorophium acherusicum*		
060104170402	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Corophiidae	*Monocorophium* sp. A		of Lecroy, 2004
060104170403	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Corophiidae	*Monocorophium tuberculatum*		
060104170501	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Corophiidae	*Laticorophium baconi*		
060104200000	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Caprellidae	Caprellidae spp.		
060104200100	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Caprellidae	*Caprella* spp.		
060104200103	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Caprellidae	*Caprella equilibra*		
060104200200	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Caprellidae	*Paracaprella* spp.		
060104200201	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Caprellidae	*Paracaprella tenuis*		
060104200202	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Caprellidae	*Paracaprella pusilla*		
060104200401	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Caprellidae	Caprellidae sp. A		of Knight-Gray, pers. comm.
060104220101	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Platyischnopidae	*Eudevenopus honduranus*		
060104250101	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Podoceridae	*Podocerus brasiliensis*		
060104260101	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Photidae	*Photis* cf. *longicaudata*		Lecroy et al., 2009
060104260103	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Photidae	*Photis macromana*		
060105000006	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda		Paguroidea spp.	Superfamily	
060105000011	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda		Brachyura spp.	Infraorder	
060105010000	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda	Penaeidae	Penaeidae spp.		
060105130000	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda	Panopeidae	Panopeidae spp.	=Xanthidae spp.	
060105160000	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda	Portunidae	Portunidae spp.		
060105220100	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda	Hepatidae	*Hepatus* spp.		
060106010205	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Mysida	Mysidae	*Americamysis stucki*		
060107000000	Arthropoda	Crustacea	Hexanauplia	Thecostraca	Sessilia		Sessilia spp.		
070301010000	Echinodermata	Eleutherozoa	Ophiuroidea		Ophiurida	Amphiuridae	Amphiuridae spp.		
070301010301	Echinodermata	Eleutherozoa	Ophiuroidea		Ophiurida	Amphiuridae	*Amphiodia atra*	=Micropholus atra	
070301020101	Echinodermata	Eleutherozoa	Ophiuroidea		Ophiurida	Ophiactidae	*Hemipholis cordifera*	=Hemipholis elongata	Hendler, 2011
090101010100	Phoronida						*Phoronis* spp.		

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110100000000	Chordata	Tunicata	Ascidiacea				Ascidiacea spp.	Colonial; present	
110501010101	Chordata		Cephalochordata		Amphioxiformes	Branchiostomatidae	*Branchiostoma floridae*		
130101000003	Bryozoa (Ectoprocta)		Gymnolaemata		Cheilostomatida		Membraniporoidea spp.	Colonial; present, Superfamily	
130101010000	Bryozoa (Ectoprocta)		Gymnolaemata		Cheilostomatida	Electridae	Electridae spp.	Colonial; present	
130101010101	Bryozoa (Ectoprocta)		Gymnolaemata		Cheilostomatida	Electridae	*Conopeum tenuissimum*	Colonial; present	
130101010201	Bryozoa (Ectoprocta)		Gymnolaemata		Cheilostomatida	Electridae	*Arbocuspis bellula*	Colonial: present	
130101020202	Bryozoa (Ectoprocta)		Gymnolaemata		Cheilostomatida	Membraniporidae	*Biflustra denticulata*	Colonial; present	
130101030200	Bryozoa (Ectoprocta)		Gymnolaemata		Cheilostomatida	Schizoporellidae	*Schizoporella* spp.	Colonial; present	Winston, 1982
130101050101	Bryozoa (Ectoprocta)		Gymnolaemata		Cheilostomatida	Bugulidae	*Bugula neritina*	Colonial; present	
130101060100	Bryozoa (Ectoprocta)		Gymnolaemata		Cheilostomatida	Epistomiidae	*Synnotum* spp.	Colonial; present	
130102010301	Bryozoa (Ectoprocta)		Gymnolaemata		Ctenostomatida	Vesiculariidae	*Amathia distans*	Colonial; present	
130102010302	Bryozoa (Ectoprocta)		Gymnolaemata		Ctenostomatida	Vesiculariidae	*Amathia alternata*	Colonial: present	
130102030100	Bryozoa (Ectoprocta)		Gymnolaemata		Ctenostomatida	Aeverrilliidae	*Aeverrillia* spp.	Colonial: present	
150101010101	Sipuncula		Sipunculidea		Golfingiiformes	Phascoliidae	*Phascolion cryptum*	=Phascolion cryptus	Cutler, 1994
160000000000	Echiura						Echiura spp.		
160101010101	Echiura		Echiuroidea		Echiuroinea	Echiuridae	*Thalassema philostracum*		

APPENDIX 2
PHYLOGENETIC TAXONOMIC LIST FOR PLANKTON SAMPLES
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Species ID	Phylum	Subphylum	Class	Subclass	Order	Family	Taxa	Species Notes	Reference
010000000000	Cnidaria						Cnidaria spp.		
010300000000	Cnidaria		Hydrozoa				Hydrozoa spp.	Colonial; present	
020103000000	Platyhelminthes	Rhabditophora			Rhabdocoela		Rhabdocoela spp.		
040100000000	Annelida		Polychaeta				Polychaeta spp.		
040105020000	Annelida		Polychaeta	Sedentaria	Spionida	Spionidae	Spionidae spp.		
050111010000	Mollusca		Gastropoda	Caenogastropoda	Littorinimorpha	Naticidae	Naticidae spp.		
050200000000	Mollusca		Bivalvia				Bivalvia spp.		
060102010100	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Cumacea	Diastylidae	*Oxyurostylis* spp.		
060104150000	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Ampithoidae	Ampithoidae spp.		
060104170001	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Corophiidae	Corophiidae spp.		
060104170402	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Corophiidae	*Monocorophium* sp. A		of Lecroy, 2004
060104200103	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Caprellidae	*Caprella equilibra*		
060104200201	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Caprellidae	*Paracaprella tenuis*		
060104250101	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Amphipoda	Podoceridae	*Podocerus brasiliensis*		
060105000000	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda		Decapoda spp.		
060105000011	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Decapoda		Brachyura spp.	Infraorder	
060106010000	Arthropoda	Crustacea	Malacostraca	Eumalacostraca	Mysida	Mysidae	Mysidae spp.		
060107000003	Arthropoda	Crustacea	Hexanauplia	Thecostraca			Cirripedia spp.	Infraclass	
060150000001	Arthropoda	Crustacea	Hexanauplia	Copepoda			Copepoda spp.	Subclass	
060151000000	Arthropoda	Crustacea	Hexanauplia	Copepoda	Calanoida		Calanoida spp.		
060151020000	Arthropoda	Crustacea	Hexanauplia	Copepoda	Calanoida	Pontellidae	Pontellidae spp.		
060151020101	Arthropoda	Crustacea	Hexanauplia	Copepoda	Calanoida	Pontellidae	*Labidocera aestiva*		
060151030101	Arthropoda	Crustacea	Hexanauplia	Copepoda	Calanoida	Temoridae	*Temora turbinata*		
060151040100	Arthropoda	Crustacea	Hexanauplia	Copepoda	Calanoida	Centropagidae	*Centropages* spp.		
060154000000	Arthropoda	Crustacea	Hexanauplia	Copepoda	Misophrioida		Misophrioida spp.		
060155000000	Arthropoda	Crustacea	Hexanauplia	Copepoda	Siphonostomatoida		Siphonostomatoida spp.		
100000000000	Hemichordata						Hemichordata spp.		
110200000000	Chordata	Tunicata	Appendicularia				Appendicularia spp.		
110301000000	Chordata	Tunicata	Thaliacea		Doliolida		Doliolida spp.		
110605010000	Chordata	Vertebrata	Actinopterygii		Myctophiformes	Myctophidae	Myctophidae spp.		
110607010000	Chordata	Vertebrata	Actinopterygii		Pleuronectiformes	Bothidae	Bothidae spp.		
110609010000	Chordata	Vertebrata	Actinopterygii		Clupeiformes	Engraulidae	Engraulidae spp.		
110610010000	Chordata	Vertebrata	Actinopterygii		Gadiformes	Bregmacerotidae	Bregmacerotidae spp.		
110610020000	Chordata	Vertebrata	Actinopterygii		Gadiformes	Phycidae	Phycidae spp.		
110611010000	Chordata	Vertebrata	Actinopterygii		Scorpaeniformes	Scorpaenidae	Scorpaenidae spp.		
120101010201	Chaetognatha		Sagittoidea		Aphragmophora	Sagittidae	*Ferosagitta hispida*		
190000000000	Ctenophora						Ctenophora spp.		