

# **Fort Bend County**

## **Levee Improvement District No. 19**

**Aptim Environmental & Infrastructure, Inc.**

**Job Order No. 04**

**October 11, 2018**

### **Steep Bank Creek Regional Watershed Hydrologic and Hydraulic Modeling Study**

#### **BACKGROUND**

On August 25, 2017, Hurricane Harvey impacted the Gulf Coast of Texas causing record setting rainfall in the Houston metro area on August 26 and 27. Over a seven-day period, it was reported that Fort Bend County received over 34 inches of rain. This unprecedented rain event resulted in flooding of the homes within the Fort Bend County Levee Districts including Levee Improvement District No. 19 (LID 19). This large flood event has produced a need for LID 19 to develop a regional watershed model to evaluate flood risk within the Steep Bank Creek Regional Watershed.

As requested, APTIM is providing this scope of services to provide engineering services to perform a Regional Watershed Hydraulic and Hydrology Study of the Steep Bank Creek Watershed including detailed Lidar acquisition, topographic and bathymetric survey, existing information gathering, and hydrologic and hydraulic modeling.

#### **SCOPE OF SERVICES OVERVIEW**

The intent of these services is for APTIM to perform a regional watershed study effort to evaluate and model the hydrologic and hydraulic conditions of the Steep Bank Creek Regional Watershed. The study area will include LID 19, LID 15, First Colony LID, MUD 46, and MUD 115. The study will provide a hydrologic and hydraulic model of the current watershed, identification of current flood risk, and the models will act as a template platform for future development evaluation, changing conditions, and proposed projects evaluation tool. The objectives of the study will be as follows:

- Model the current hydrologic and hydraulic conditions of the Steep Bank Creek Regional Watershed. This regional area is provided in Attachment A.
- Identify current flood risk, specifically for large low-frequency flood events, within the Steep Bank Creek Regional Watershed
- Develop a modeling tool and an asset to maintain within the Steep Bank Creek LIDs and MUDs. This will allow the districts to continue to model and evaluate the changing conditions in the watershed.

The summary of the phases and components of the regional watershed study:

- Task 1: Survey Data Collection and Existing Information Gathering

APTIM and the team will perform a light imaging, detection, and ranging (LIDAR) survey for the entire regional watershed, and ground truth topographic and bathymetric survey of major water bodies and flooded areas within LID 19. The survey data will be collected and processed into a digital elevation model, and this will be used in the hydrologic and hydraulic models. The items in this task will include:

1. LIDAR acquisition of the entire watershed with ground truth verification.
2. Additional Ground Truth Survey including bathymetric survey of major water bodies within the watershed and topographic survey of flooded areas in LID 19.
3. Existing information gathering of existing drainage structures

- Task 2: Hydrologic and Hydraulic Modeling and Reporting

APTIM will develop hydrologic and hydraulic modeling effort to evaluate flood risk within the regional watershed using the current design storms identified in the FBC-DCM 2011. The effort will also begin to prepare for the future design storms and will evaluate the new design storm frequencies in the preliminary NOAA Atlas 14 data. Additionally, the effort will evaluate a design storm equivalent of Hurricane Harvey.

1. Hydrologic model
2. 2D Hydraulic model

- Project Management, quality assurance/quality control (QA/QC) and Reporting

The details of each task are described in the following sections.

### **TASK 1: SURVEY DATA COLLECTION AND EXISTING INFORMATION GATHERING**

APTIM and the project team will perform the following services for data collection:

- LIDAR – The survey scope includes acquisition of LIDAR survey data and planimetric processing of an approximately 6.7 square mile area of interest. The data acquisition will include LID 19, LID 15, First Colony LID, MUD 46, MUD 115, and Snake Slough. LIDAR survey deliverables will include DTM and DEM models, planimetric data modeling, Orthomosaic photos, and QC report. The LIDAR will be collected at a flying altitude of 150 meters (492 ft.) with a data density of approximately 70 points per square meter (6.5 pts/ft<sup>2</sup>).
- Topographic and Bathymetric Survey – Additional ground truth surveying and as-built checks will be performed for the Steep Bank Creek Regional Watershed area. Additional focus will be as follows:
  - Bathymetric check surveys on Alcorn Bayou, Snake Slough, Steep Bank Creek, and immediately adjacent areas. Bathymetric surveys will also be performed on major lakes, ponds and storage features that do not have as-built information available (if necessary).
  - Topographic check surveys of the developed areas of LID 19 in areas that flooded during Hurricane Harvey will be performed. These surveys will include a sampling of slab surveys of homes that flooded during Harvey, and spot elevations of street that flooded during the storm event.
- Existing Information Gathering – Existing information gathering to provide component properties of existing drainage structures. The scope of this effort includes collection and analysis of as-built drawings for drainage crossings within the entire watershed area. At a minimum, information to be determined will be as followings:
  - Culvert crossing properties to be determined include size, length and inverts of associated channel crossings.
  - Bridge crossings properties will include determination of invert, abutment geometry, low chord, high cord of bridge crossing, and apron or scours protection areas.
  - Channel cross sectional properties

## **TASK 2: HYDROLOGIC AND HYDRAULIC MODELING**

- **Data Review** – Initial data review of prior existing relevant data, previous studies, and technical criteria and regulatory guidance documentation. This includes GIS data, hydrologic data including stream flow records and historical flood stage, prior modeling analysis of basins and downstream reaches, and pump station, pond, and levee as-built information.
- **Hydrologic Modeling** - A hydrologic model will be developed for the Steep Bank Creek Regional Watershed. This modeled area is shown in a figure in Attachment A. Hydrologic modeling will include 7 design storm events for the sub-basin areas that reside with the watershed areas. The design storms used in the effort will include the following:
  - The 25-, 50-, and 100-year design storms from the National Oceanic and Atmospheric Administration's (NOAA) Technical Paper No. 40
  - The 25-, 50-, and 100-year design storms from NOAA's update Atlas-14 Study
  - The equivalent of the 2017 Hurricane Harvey Historical event
- **2D Hydraulic Modeling** – A 2D hydraulic model will be developed for the Steep Bank Creek Regional Watershed. This modeled area is shown in a figure in Attachment A. The effort will evaluate the performance of the following:
  - The existing geometry and drainage structures under the seven (7) design storms listed in the Hydrologic Modeling task.
  - Three (3) alternative drainage improvements under the seven (7) design storms listed in the Hydrologic Modeling task.
  - The events will be evaluated under gravity flow and coincidental event (pump) flow

## **PROJECT MANAGEMENT, QA/QC, REPORTING AND MEETINGS**

APTIM and our proposed subcontractors (the project team) will perform the following services for Project Management, QA/QC, reporting, and meetings:

- **Project Management and QA/QC**

APTIM will provide project management services to plan, organize, and manage the effort to provide a successful regional watershed modeling study. APTIM will manage the scope, schedule, quality and budget for the project team.

APTIM and the project team will ensure that all work and associated documentation for this effort will be accurate and will comply with industry standards. APTIM has an integrated QA/QC plan that will be implemented throughout the project. Additionally, APTIM's LIDAR subcontractor, Fugro, has QC procedures that call for accuracy checks to be performed at base stations locations during the LIDAR flight.

- **Meetings**

Meetings will be held regularly with the project team as necessary to execute the effort. APTIM will update the LID 19 Board members regularly at monthly board meetings. APTIM will also perform the following meetings:

1. Coordinate and conduct progress meetings with LID 19 personnel when necessary
2. If necessary, provide questions and/or conduct interviews to aid in clarifying any assumptions or methodologies included in the design

- Report Development

APTIM will develop a report summarizing the modeling methods, assumptions, and results. The report will also include:

1. A detailed report including an executive summary
2. Compilation of all documentation from the survey data collection and existing information work
3. Compilation of the modeling output and results
4. Key findings and Conclusions

### **DELIVERABLES**

APTIM will provide the following deliverables for each task of work:

#### **Task 1: Survey Data Collection and Existing Information Gathering**

- LIDAR
  1. 1 hard copy and digital copy of the LIDAR Control Report and QA/QC Report
  2. 1 digital copy of the LIDAR Data Collection Files including
    - a. Orthomosaics of Project Area
    - b. 2D Planimetrics of the Project Area
    - c. Contour Maps
    - d. Digital Elevation Model (DEM) and Digital Surface Model (DTM)
- Topographic and Bathymetric Survey
  1. One (1) digital copy of all AutoCAD Civil 3D survey files
  2. One (1) hard copy and digital copy of topographic and bathymetric survey stamped and certified by a Texas Registered Professional Land Surveyor
- Existing Information Gathering
  1. One (1) digital copy of electronic files collected in the existing information gathering task

#### **Task 2: Hydrologic and Hydraulic Modeling**

- Hydrologic and Hydraulic Modeling
  1. One (1) digital copy of all Hydrologic and Hydraulic Modeling Files
  2. One (1) hard copy of Hydrologic and Hydraulic Modeling Files output
- Report
  1. Ten (10) hard copies of spiral bound report
  2. Five (5) digital copies of the report on individual jump drives (digital copy will be place on portal for downloading as well)

## SCHEDULE

APTIM will provide draft deliverables for the phases of work according to the following schedule:

- Task 1: Survey Data Collection and Existing Information Gathering
  - Draft Deliverables will be provided within 3 months of a written NTP
- Task 2: Hydrologic and Hydraulic Modeling
  - Draft Deliverables will be provided within 7 months of a written NTP

APTIM will finalize the reports from both phases of work within 1 month after receipt of comments from LID 19. All final deliverables will be submitted within eight (8) months from a written NTP.

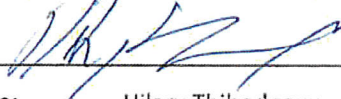
## PRICE (NOT TO EXCEED)

Work will be performed on a time and material basis for an estimated total price **\$285,000.00** under the mutually agreed upon terms and conditions of the 2017 Master Services Agreement. The detailed breakdown on cost is as follows:


Task	Cost Estimate
Task 1: Survey Data Collection and Existing Information Gathering	
• LIDAR Survey	\$78,764
• Topographic and Bathymetric Survey	\$43,296
• Existing Information Gathering	\$5,835
Sub-total	\$127,895
Task 2: Hydrologic and Hydraulic Modeling	
• Hydrologic and Hydraulic Modeling	\$114,949
• Report	\$21,756
• Project Management & QA/QC	\$20,400
Sub-total	\$157,105
<b>TOTAL</b>	<b>\$285,000</b>

We appreciate the opportunity to provide our professional services to you. If you have any questions or require any additional information, please contact me at 985-868-3434.

## **APTIM ENVIRONMENTAL & INFRASTRUCTURE, INC.**

By:  Date: 10/19/18  
Name: Hilary Thibodeaux  
Title: Director, Engineer

## **Fort Bend County Levee Improvement District No. 19**

By:  Date: 10/19/18  
President, Board of Directors

# **ATTACHMENT A**



