

**PROFESSIONAL SERVICES AGREEMENT  
FOR  
ENGINEERING SERVICES  
RELATED TO  
ENGINEERING & PLANNING PROJECT NO. 2023-10008  
CITY OF TOMBALL  
DRAINAGE MASTER PLAN**

**THE STATE OF TEXAS           §  
  §  
COUNTY OF HARRIS         §**

THIS AGREEMENT made on the \_\_\_\_\_ day of \_\_\_\_\_, 2023 entered into, and executed by and between the City of Tomball, Texas (the “City”), a municipal corporation of the State of Texas, and Civil Systems Engineering, Inc. (“Engineer”).

**WITNESSETH:**

WHEREAS, the City desires to develop / update the City of Tomball Drainage Master Plan, (the “Project”); and

WHEREAS, the services of a professional engineering firm are necessary to provide project planning, project design, and preparation of construction documents, and

WHEREAS, the Engineer represents that it is fully capable and qualified to provide professional services to the City related to professional engineering;

NOW, THEREFORE, the City and Engineer, in consideration of the mutual covenants and agreements herein contained, do mutually agree as follows:

**SECTION I  
SCOPE OF AGREEMENT**

Engineer agrees to perform certain professional engineering services as defined in Attachment “A” attached hereto and made a part hereof for all purposes, hereinafter sometimes referred to as “Scope of Work,” and for having rendered such services, the City agrees to pay Engineer compensation as stated in Section VII.

**SECTION II  
CHARACTER AND EXTENT OF SERVICES**

Engineer shall do all things necessary to render the engineering services and perform the Scope of Work in a professional and workmanlike manner. It is expressly understood and agreed that Engineer is an Independent Contractor in the performance of the services agreed to herein. It is further understood and agreed that Engineer shall not have the authority to obligate or bind the City, or make representations or commitments on behalf of the City or its officers or employees without the express prior

approval of the City. The City shall be under no obligation to pay for services rendered not identified in Attachment "A" without prior written authorization from the City.

### **SECTION III OWNERSHIP OF WORK PRODUCT**

Engineer agrees that the City shall have the right to use all exhibits, maps, reports, analyses and other documents prepared or compiled by Engineer pursuant to this Agreement. The City shall be the absolute and unqualified owner of all studies, exhibits, maps, reports, analyses, determinations, recommendations, computer files, and other documents prepared or acquired pursuant to this Agreement with the same force and effect as if the City had prepared or acquired the same.

### **SECTION IV TIME FOR PERFORMANCE**

The time for performance of the Scope of Work is an estimated 550 calendar day duration beginning from the execution date of this Agreement, (Detailed Estimated Timeline include in Attachment A). Upon written request of Engineer, the City may grant time extensions to the extent of any delays caused by the City or other agencies with which the work must be coordinated and over which Engineer has no control.

### **SECTION V COMPLIANCE AND STANDARDS**

Engineer agrees to perform the work hereunder in accordance with generally accepted standards applicable thereto and shall use that degree of care and skill commensurate with the applicable profession to comply with all applicable state, federal, and local laws, ordinances, rules, and regulations relating to the work to be performed hereunder and Engineer's performance.

### **SECTION VI INDEMNIFICATION**

To the fullest extent permitted by Texas Local Government Code Section 271.904, Engineer shall and does hereby agree to indemnify, hold harmless and defend the City, its officers, agents, and employees against liability for damage caused by or resulting from an act of negligence, intentional tort, intellectual property infringement, or failure to pay a subcontractor or supplier committed by the Engineer, the Engineer's agent, consultant under contract, or another entity over which the Engineer exercises control.

### **SECTION VII ENGINEER'S COMPENSATION**

For and in consideration of the services rendered by Engineer pursuant to this Agreement, the City shall pay Engineer only for the actual work performed under the

Scope of Work, on the basis set forth in Attachment "A," up to an amount not to exceed \$844,000 including reimbursable expenses as identified in Attachment "A."

## **SECTION VIII TERMINATION**

The City may terminate this Agreement at any time by giving written notice to Engineer. Upon receipt of such notice, Engineer shall discontinue all services in connection with the performance of this Agreement and shall proceed to promptly cancel all existing orders and contracts insofar as such orders or contracts are chargeable to the Agreement. As soon as practicable after receipt of notice of termination, Engineer shall submit a sworn statement, showing in detail the services performed under this Agreement to the date of termination. The City shall then pay Engineer for such services performed under this Agreement as those services bear to the total services called for under this Agreement, less such payments on account of the charges as have been previously made. Copies of all completed or partially completed designs, maps, studies, documents and other work product prepared under this Agreement shall be delivered to the City when and if this Agreement is terminated.

## **SECTION IX ADDRESSES, NOTICES AND COMMUNICATIONS**

All notices and communications under this Agreement shall be mailed by certified mail, return receipt requested, to Engineer at the following address:

Civil Systems Engineering, Inc.  
1202 Lake Pointe Parkway  
Sugar Land, TX 77478  
Attn: Kurt Killian, P.E., CFM

All notices and communications under this Agreement shall be mailed by certified mail, return receipt requested, to the City at the following address:

City of Tomball  
501 W. Market Street  
Tomball, Texas 77375  
Attn: Drew Huffman, Public Works Director

## **SECTION X LIMIT OF APPROPRIATION**

Prior to the execution of this Agreement, Engineer has been advised by the City and Engineer clearly understands and agrees, such understanding and agreement being of the absolute essence to this Agreement, that the City shall have available only those sums as expressly provided for under this Agreement to discharge any and all liabilities which may be incurred by the City and that the total compensation that Engineer may

become entitled to hereunder and the total sum that the City shall become liable to pay to Engineer hereunder shall not under any conditions, circumstances, or interpretations hereof exceed the amounts as provided for in this Agreement.

## **SECTION XI SUCCESSORS AND ASSIGNS**

The City and Engineer bind themselves and their successors and assigns to the other party of this Agreement and to the successors and assigns of such other party, in respect to all covenants of this Agreement. Engineer shall not assign, sublet, or transfer its interest in this Agreement without the written consent of the City. Nothing herein shall be construed as creating any personal liability on the part of any officer or agent of the City or any public body which may be a party hereto.

## **SECTION XII MODIFICATIONS**

This instrument, including Attachment "A," contains the entire Agreement between the parties relating to the rights herein granted and the obligations herein assumed. To the extent there is a conflict between the provisions of this Agreement and the provisions of Attachment "A," this Agreement shall control. Any oral or written representations or modifications concerning this instrument shall be of no force and effect excepting a subsequent modification in writing signed by both parties hereto.

## **SECTION XIII ADDITIONAL SERVICES OF ENGINEER**

If authorized in writing by the City, Engineer shall furnish, or obtain from others, Additional Services that may be required because of significant changes in the scope, extent or character of the portions of the Project designed or specified by the Engineer, as defined in Attachment "A." These Additional Services, plus reimbursable expenses, will be paid for by the Owner on the basis set forth in Attachment "A," up to the amount authorized in writing by the City.

## **SECTION XIV CONFLICTS OF INTEREST**

Pursuant to the requirements of the Chapter 176 of the Texas Local Government Code, Engineer shall fully complete and file with the City Secretary a Conflict of Interest Questionnaire.

## **SECTION XV PAYMENT TO ENGINEER FOR SERVICES AND REIMBURSABLE EXPENSES**

Invoices for Basic and Additional Services and reimbursable expenses will be prepared in accordance with Engineer's standard invoicing practices and will be

submitted to the City by Engineer at least monthly. Invoices are due and payable thirty (30) days after receipt by the City.

## **SECTION XVI INSURANCE**

Engineer shall procure and maintain insurance in accordance with the terms and conditions set forth in Attachment "B," for protection from workers' compensation claims, claims for damages because of bodily injury, including personal injury, sickness or disease or death, claims or damages because of injury to or destruction of property including loss of use resulting therefrom, and claims of errors and omissions.

## **SECTION XVII MISCELLANEOUS PROVISIONS**

A. This Agreement is subject to the provisions of the Texas Prompt Payment Act, Chapter 2250 of the Texas Government Code. The approval or payment of any invoice shall not be considered to be evidence of performance by Engineer or of the receipt of or acceptance by the City of the work covered by such invoice.

B. Venue for any legal actions arising out of this Agreement shall lie exclusively in the federal and state courts of Harris County, Texas.

C. This Agreement is for sole benefit of the City and Engineer, and no provision of this Agreement shall be interpreted to grant or convey to any other person any benefits or rights.

D. Contractor further covenants and agrees that it does not and will not knowingly employ an undocumented worker. An "undocumented worker" shall mean an individual who, at the time of employment, is not (a) lawfully admitted for permanent residence to the United States, or (b) authorized by law to be employed in that manner in the United States.

E. In accordance with Chapter 2270 and 2252, Texas Government Code, a government entity may not enter into a contract with a company for goods or services unless the Engineer covenants and agrees that it: (1) does not boycott Israel; and (2) will not boycott Israel during the term of the contract. Furthermore, the Engineer is prohibited from engaging in business with Iran, Sudan, or Foreign Terrorist Organization.


F. In accordance with Chapter 2274, Texas Government Code, a government entity may not enter into a contract with a company for goods or services unless the Engineer covenants and agrees that it: (1) does not Boycott Energy Companies; (2) will not Boycott Energy Companies during the term of the contract; (3) does not have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association; and (4) will not discriminate during the term of the contract against a firearm entity or firearm trade association.

IN WITNESS WHEREOF, the City of Tomball has lawfully caused this Agreement to be executed by the City Manager of said City and attested by the City Secretary and Civil Systems Engineering, Inc. acting by and through its duly authorized officer/representative, does now sign, execute, and deliver this instrument.

EXECUTED on this \_\_\_\_\_ day of \_\_\_\_\_, 2023.

**ENGINEER:**

**Civil Systems Engineering, Inc.** \_\_\_\_\_

By:  \_\_\_\_\_  
Name: Kurt Killian, PE, CFM  
Title: Vice President

**CITY OF TOMBALL, TEXAS**

\_\_\_\_\_  
David Esquivel, PE, City Manager

**ATTEST:**

\_\_\_\_\_  
Tracy Garcia, City Secretary

## **ATTACHMENT “A”**

### **PART A – SCOPE OF SERVICES AND DELIVERABLE DOCUMENTS**

#### **ENGINEERING & PLANNING PROJECT NO. 2023-10008**

#### **CITY OF TOMBALL DRAINAGE MASTER PLAN**

### **1.0 GENERAL**

The Engineer shall provide professional engineering services as described in the Contract and as further defined by this Attachment A, Scope of Services.

#### **DESCRIPTION OF PROJECT**

The Project generally is described as, providing engineering and planning services required for developing / updating the City of Tomball’s Drainage Master Plan. This effort shall be in conformance with Local Government Code, Title 12, Planning and Development, Chapter 395, Financing Capital Improvements Required by New Development in Municipalities, Counties, and Certain Other Local Governments.

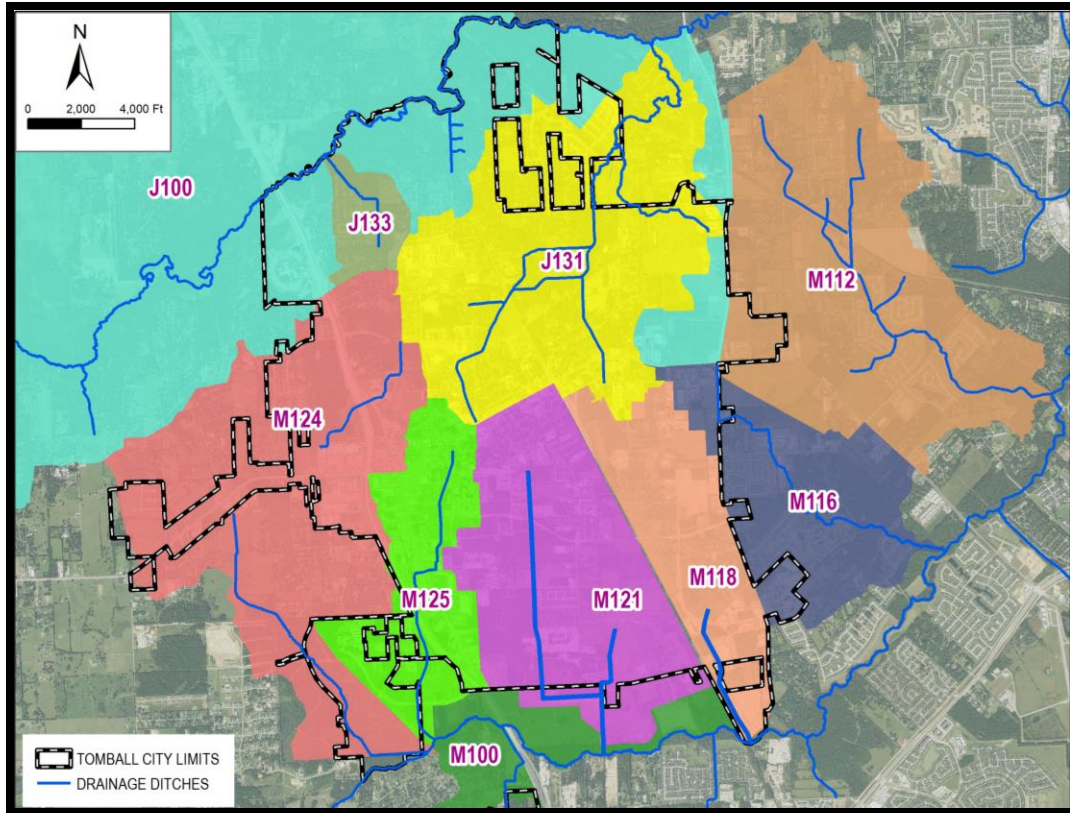
### **2.0 SCOPE OF SERVICES**

#### **Overview**

The City of Tomball (City) is a fast-growing municipality in northwest Harris County, about 40 miles north of Houston, accessible via State Highway 249 and FM 2920. The City is comprised of approximately 12 square miles of land within the city limits with additional developable land in its extra-territorial jurisdiction, as shown in Figure 1.

Tomball has a population of about 12,500 people and daily visitor traffic of about 30,000. The City has and is experiencing significant growth. Recent developments include new residential and commercial centers and the expansion of major roadways. The City is expected to continue to grow, both in population and economic vitality, resulting in the need for additional drainage infrastructure improvements. The previous City of Tomball drainage master plan was published in 2014 and does not reflect current conditions, development growth needs, and latest drainage methodologies, criteria, and analysis technology. The combination of the age of the previous master drainage study, anticipated City growth, latest methodologies and technologies, and drainage improvements since the previous master plan requires that a new drainage master plan be developed.

The objective of this study is to develop a comprehensive Drainage Master Plan (DMP) and make recommendations of needed capital projects to address existing and future drainage issues, drainage infrastructure needs, and flood relief. In addition, this study will investigate and update the current drainage impact fee structure. The resulting drainage master plan and the recommended drainage impact fee and stormwater utility fee structure will provide sufficient information for the City to plan, fund, and implement future drainage / flood control. This effort shall be in conformance with Local Government Code, Title 12, Planning and Development, Chapter 395, Financing Capital Improvements Required by New Development in Municipalities, Counties, and Certain Other Local Governments.



**Figure 1: City of Tomball Drainage Master Plan Study Area**

## Scope of Work

Major tasks to be performed to achieve the DMP study objectives include:

1. Project Management
2. Stakeholder Outreach and Agency Coordination
3. Data Collection and Review
4. Site Investigation and Field Survey
5. GIS Base Mapping/ Geodatabase Development
6. Development of Hydrologic and Hydraulic Models
7. Existing Conditions Modeling Analysis
8. Future Conditions Modeling Analysis
9. Alternative Analysis
10. Preliminary Environmental Assessment
11. Benefit-Cost Analysis
12. Drainage Impact Fee / Stormwater Utility Fee
13. Capital Improvement Plan (CIP)
14. Review and Update Drainage Criteria and Standards
15. Final DMP Report
16. Grant Applications



### **Task 1: Project Management**

1. Civil Systems Engineering, Inc. (CSE) will attend a kick-off meeting with City of Tomball (City), other stakeholders, and key team members to discuss the project needs, objectives, expectations, scope, budget and schedule, reporting, invoicing / billing, critical issues, deliverables, responsibility assignments, and communication methods, to ensure a clear understanding of the project expectation and concerns.
2. Conduct bi-weekly progress meetings (24 max) with the City PM and staff. Meetings shall be virtually conducted via MS Teams. CSE will prepare meeting agendas and document meeting minutes. Upon City request, virtual meetings may be conducted in-person, as needed.
3. Prepare monthly progress reports and invoicing for submission to the City.
4. CSE will aid the City in the preparation of grant funding applications for potential CIP and flood relief projects within the study area as proposed within this DMP.
5. QA/QC review will be performed for all submittals.

### **Task 2: Stakeholder Outreach & Agency Coordination**

CSE will assist the City with conducting steering committee, stakeholder, CPAC, and outside agency coordination meetings during the course of the project. CSE will collaborate with on-going outside agency (eg. City, TxDOT, HCFCD, or Harris County) studies, planning, and projects related to the City's drainage infrastructure planning and attend coordination meetings as needed. Additionally, CSE will assist the City for the final presentation of the project to City Council. All meetings will be documented and included within the technical report.

### **Task 3: Data Collection and Review**

CSE will collect most current LiDAR topographic data, soil and land use data, drainage studies, plan sets, Flood Insurance Study (FIS), floodplain and inundation maps, repetitive loss structures, land use and future development, and other available pertinent data associated with the study (City of Tomball, TWDB, TNRIS, USGS, NRCS, HCFCD, Harris County, HGAC, & TxDOT). CSE will review the collected data and leverage the information for model updates and plan formulation / evaluation, and identification of potential stream gages. Utility information and other City infrastructure will be taken from City's GIS system. CSE will identify known flooding / drainage problem areas (existing drainage/ flood control systems, flooded structures/ critical infrastructures, roadway segments, erosions, existing drainage criteria, etc). CSE will provide the City with a comprehensive digital compilation of all materials collected.

### **Task 4: Site Investigations & Field Survey**

CSE will conduct site visits & field investigations to observe and assess existing hydrologic and hydraulic conditions, including internal drainage systems and hydraulic structures for clarity of modeling conditions and constraints. Field observations will be documented and a photo log generated.

CSE will perform limited field surveys to collect topographic data for channel cross-sections, cross-drainage structures, and storm sewer trunklines to supplement existing available data. The survey topography will be utilized in conjunction with the latest LiDAR topography, previous survey, and as-builts to generate a project level DEM and provide structure details sufficient to develop hydrologic and hydraulic models to analyze the existing stream, drainage, and storm systems as well as to propose and analyze improvement alternatives.

Field survey will be conducted under the supervision of a Registered Professional Land Surveyor currently registered with the Texas Board of Professional Engineers and Land Surveyors. All survey related services shall be in accordance with the Rules and Acts of the Texas Board of

Professional Engineering and Land Surveying. All survey coordinate geometry must be based on and tied to NAD-83 State Plane Coordinate System (horizontal) and NAVD88 (vertical) datum coordinate systems; a surface adjustment factor for project study area will be provided.

Surveying of existing closed conduit storm sewer systems will be performed, as needed, to supplement current available truck line system data. Storm sewer surveyed elevations will be compared against as-builts and other study information to validate information. Final determination of storm sewer survey data collection needs, including channel cross-sections, manhole dips and outlet structures, will be identified during the project development.

A survey inventory exhibit will be provided within the report to illustrate locations of surveyed cross-sections, structures, and bridges. Survey inventory photo log will be provided within the report appendices.

#### **Task 5: GIS Base Mapping and Geodatabase Development**

CSE will build upon the City's GIS and perform GIS base mapping for the project overlay the collected geospatial datasets including aerial photographs, vector street maps, political boundaries, land use, benchmarks, stream and drainage ditch centerlines, storm sewer systems, water bodies, highwater marks, FEMA floodplain, and inundation mapping. Current LiDAR DEM datasets will also be overlaid along with other geospatial data layers. CSE will develop a hydrologically correct project DEM dataset from the current TNRS LiDAR data by examining LiDAR data at stream crossings (bridge/ culverts) based on Google Map and site visits.

As part of the project, a set of GIS layers will be updated / developed as part of an overall project geodatabase to document the project's data collection, proposed plans, and analysis results. The project geodatabase will be provided to the City for incorporation into the City's GIS system.

#### **Task 6: Development of Hydrologic and Hydraulic Models**

##### Hydrologic Modeling & Analysis

CSE will first review the available hydrologic models (eg. HEC-HMS) from FEMA, HCFCD, and Harris County related to study area. Additional study models will be reviewed and incorporated (eg. M118 and M121). Where necessary, updates to drainage areas and watershed parameters will be performed based on the current high precision LiDAR dataset and field data. Where no previous study exists, new subbasin delineations and hydrologic parameters will be developed using ArchHydro, GeoHMS, and/or latest version HEC-HMS.

- CSE will perform watershed processing, including basin processing, basin characteristics estimation, and analysis / model setup. Basin processing will be performed to delineate and edit subbasins based on preliminary watershed and stream delineations from terrain processing with project specifications. GIS tools, GeoHMS or latest HEC-HMS will be used to compute hydrologic parameters with tables of physical characteristics of the streams and watersheds. Stream physical characteristics, such as length, upstream and downstream elevations, and slope, will be extracted from the terrain data. Similarly, the subbasin physical characteristics, such as longest flow lengths, centroidal flow lengths, and slopes. These physical characteristics will then be exported and used externally to estimate hydrologic parameters for each hydrological unit based on current HCFCD criteria and methodology.
- CSE will utilize HCFCD Region 1 latest Atlas 14 rainfall, 24-hour storm duration for hydrologic modeling analyses.
- CSE will utilize the Green-Ampt Infiltration Method, based on HCFCD criteria, for hydrologic modeling and analyses.
- CSE will develop land use and land cover data for the study area for base and future projection

year conditions. CSE will download gridded landcover data from USGS website (NLCD 2016) as base land use coverage data. CSE will also obtain or generate more accurate land use data based on existing parcel maps and aerial photos (main channels, buildings, roads, etc.). Percent impervious and overland use Manning's 'N' values will be estimated and assigned to each land classification.

- Time of concentration ( $T_c$ ) will be calculated using HCFCD methodology. For localized drainage analysis, the NRCS TR-55 equations will be used to compute overland sheet flow, shallow concentrated flow, and channel/storm drain travel times. The  $T_c$  values developed for previous studies will be reviewed, refined, updated, and added to as necessary based on best available data.
- HCFCD's methodology for Clark's unit hydrograph method will be utilized for runoff transformation within HEC-HMS model.
- Stream routing within HEC-HMS will utilize modified Puls which will be developed from storage relationships extracted from the HEC-RAS hydraulic models.
- CSE will develop HEC-HMS models using input data of the drainage area delineations and estimated hydrologic parameters, precipitation data, and stream routing. Adjacent study hydrologic modeling analysis will be reviewed for consistency and errors and incorporated as appropriate for HEC-HMS modeling.
- CSE will validate hydrologic modeling using historic flooding events (discharges, hydrographs, and recorded HWMs). Additionally, rain-on-grid 2D HEC-RAS modeling will be performed to verify drainage area delineations, subbasin parameters, and HEC-HMS flow computations.
- Storm sewer hydrologic computations will be performed for urbanized areas with storm sewer networks. Drainage areas will be delineated to trunkline manhole nodal locations. Flows will be computed using the Rational Method, and runoff hydrographs will be computed and generated within HEC-HMS, EPA-SWMM, and/or XP-SWMM.

Hydrology analysis products will include hydrologic models, drainage area delineations, hydrologic parameters, and runoff flows and hydrographs for multiple frequencies (2-, 5-, 10-, 25-, and 100-year), and will be provided in tables, exhibits, and GIS geodatabase layers. The exhibits will include Overall Watershed Map, Subbasin Drainage Area Maps, Parameter Map (Landuse,  $T_c$ , Imp), Soil Map, and Storm Sewer Basin Maps.

### Hydraulic Modeling & Analysis

Hydraulic models will be created and calibrated for open channels and storm sewer trunklines to analyze the conveyance capacity of the existing systems and establish multiple frequency water surface elevations and flood inundation floodplains and identify system constraints. A citywide 1D/2D unsteady HEC-RAS hydraulic model will be developed for the entire study area. The watershed-based model better simulates the hydrologic and hydraulic interconnections of the hydrologic and hydraulic features within the study area as one system. The backwater effect, flood wave timing, shallow and wide floodplain within the watershed will be more accurately defined and modeled within a 2D environment. Geometric data and input parameters for the modeled streams will be generated within RAS Mapper and ArcGIS using the project DEM dataset, surveyed channel cross sections and structure data, as-builts, aeriels, and field observations.

Specifically, CSE will develop detailed terrain model for hydraulic modeling using GIS or RAS Mapper by merging / mosaicking of the channel terrain model (based on survey cross data) with the surface terrain model (LiDAR); determine modeling standards, methodologies, criteria, assumptions, and calibration standards for the project; develop and/or update open-channel HEC-RAS 1D steady modeling by constructing existing bank to bank channel 1D model, inputting

bridge and culvert structure geometries, defining bridge / culvert modeling approach and loss coefficients, estimating modeling parameters, such as Manning's roughness coefficients, expansion/contraction coefficients, ineffective flow areas, storage area connections, tailwater boundary conditions. Manning's roughness coefficients ("n") will be estimated based on field reconnaissance, aerial photos, other and standard engineering reference tables, or publications.

For RAS 2D modeling, CSE will develop 2D modeling GIS layers (eg. land cover, Manning's, impervious, soils, structures), generate 2D mesh for overbank areas, including breaklines, mesh connections, etc), develop hydraulic property tables (HTAB) with 2D geometric preprocessing, develop 1D hydraulic elements and 2D element connections (stream reach with lateral structure, stream to 2D area, 2D area to storage area), identify locations for in-mesh structures and weirs within the 2D mesh overbank areas, determine boundary conditions for 2D flow areas (flow hydrograph, stage hydrograph, normal depth, and rating curve, and/or precipitation). CSE will evaluate the hydraulic methods for 2D hydraulic modeling analysis - Shallow Water Equation or Diffusion Wave Equation. CSE will evaluate / optimize mesh cell sizes for specific 2D areas and computation time step. CSE will examine velocity vector and floodplain depth in RAS Mapper. CSE will calibrate 1D/2D HEC-RAS models against highwater marks and historical flood events. Verify model reliability by running calibrated model for additional historic flood events.

For urbanized areas, CSE will develop storm sewer system hydraulic models to determine capacity insufficiencies for the existing storm sewer systems, identify flood prone urban areas, overflows, ponding areas, and identify locations for potential system improvements. Storm sewer analyses will be performed at a trunkline level for all the study area. The analyzed systems will include those within City and other jurisdiction within the study area. Storm sewer systems will be analyzed using GeoPAK Drainage, EPA-SWMM, and/or XP-SWMM.

Hydraulic analysis products will include HEC-RAS models and any additional storm sewer analysis models, and multiple-frequency water surface elevations, inundation areas/ floodplains, and flood profiles. The hydraulic outputs will be provided in tables, exhibits, and GIS database layers. Exhibits will include: Overall Stream Layout Map, Stream Layout Maps with HEC-RAS modeling parameters (alignments, cross-sections, structures, 2D areas and elements), and Storm Sewer Layout Map. CSE will provide draft data to the City for review and comment prior to finalization. CSE will provide the City digital compilation of hydraulic analysis products.

#### **Task 7: Existing Conditions Modeling Analysis**

CSE will perform hydrologic/hydraulic modeling analysis and floodplain/inundation mapping for existing conditions to identify flood risk areas and improvement opportunities. CSE will identify and compile existing flood hazards in the study area including riverine flooding and urban flood inundation. Floodplain/ inundation mapping will be performed for multiple frequency events for existing conditions to establish a baseline condition. Potential structure flooding, including residential, vulnerable, and critical infrastructure, will be identified as well as documented historic flooded structures and claims. The mapping will utilize the results from the stream modeling as well as the storm sewer modeling.

Existing flood risk floodplain mapping products will include multiple-frequency floodplain/inundation exhibits and water surface elevation profiles. Historic flooding data including FEMA repetitive loss structures will be mapped and overlaid as references. The exhibits will include: Overall and Subbasin Floodplain and Inundation Area Maps (inclusive of Q's and WSE's at pertinent nodes and identified potential flooded structures), and Water Surface Elevation Profiles exhibits.

#### **Task 8: Future Condition "No-Build" Modeling Analysis**

CSE will perform hydrologic/hydraulic modeling analysis for future "No-Build" condition to predict

flood prone areas under future development conditions. CSE will develop future condition modeling based on a 30-year projected development condition. CSE will identify and compile future condition flood hazards including riverine flooding and urban inundation. Specific tasks include:

- Coordinate with the City to determine future year for analysis as well as anticipated future planning, development, land use, and major thoroughfare plans.
- Determine future storm drainage requirements of the community (design frequency, detention, etc.).
- Determine and delineate future land use (residential, Commercial, industrial, etc.).
- Adjust hydrologic model parameters for all subbasins to be affected by future land use changes (such as decreased Tc and decreased storage, loss-rate reflecting increased imperviousness and soil characteristics changes, and decreased watershed travel time).
- Compute future without-project “no-build” conditions peak discharges and hydrographs for various frequencies.
- Generate “no-build” condition hydraulic model results and floodplain area.
- Determine potential structural flooding and damages for “no-build” condition.

Future “no-build” condition flood risk floodplain mapping will include multiple-frequency floodplain/inundation exhibits and water surface elevation profiles. FEMA repetitive loss structure data will be mapped and overlaid as reference. The exhibits will include computed flows and water surface elevations at pertinent nodes and identified potential flooded structures.

#### **Task 9: Alternative Analysis**

Based on existing and future “no-build” condition modeling results and each system’s identified flooding problems and future drainage infrastructure needs, improvement measures will be proposed. The improvement measures, including structural and non-structural elements, will be evaluated separately to determine individual effectiveness and impacts. These improvements will then be combined into different alternative plans, which will be evaluated, analyzed, and compared. All improvement measures and alternative plans will be evaluated based on level of protection for existing and future conditions, effectiveness, benefit, constructability, cost, ROW needs, potential upstream/downstream impacts, environmental impacts, multi-purpose/enhancement capabilities, and public/agency acceptance.

The alternative formulation shall consider improvements to reduce the potential flooding impacts and mitigate multiple flood events. Recommendations will be made based on comparison of alternatives that provide measurable reductions in flooding impacts in support of the project’s overall flood mitigation objectives and floodplain management goals. The recommended alternative shall not adversely impact or affect neighboring areas located within or outside of the project area.

Additionally, the alternative formulation will consider drainage infrastructure needs to accommodate future roadway and development. The improvements may include drainage ditch improvements to provide storm sewer depth as well as proposed drainage lateral systems (ditch and/or storm sewer) to provide conveyance to main drainage ditches or systems.

Each flood mitigation/drainage improvement alternative, cost and benefits will be identified and compared based on an Alternative Ranking Matrix. The components considered for the matrix include, but not limited to: damage reduction for structures (residential, commercial, public facilities, and critical facilities), damage reduction for roadway and crossings, reduction in economic loss (business interruptions and temporary job lost), cost, constructability, maintenance (O&E) cost, structure resilience, environmental impacts, socio-economics, environmental

enhancement / green infrastructure, multiple purpose utilization, and ROW impacts. Specifically, quantification of cost will include engineering, permitting, easement and/or property acquisition, capital cost, operation and maintenance, and other costs as applicable.

The alternative analysis results will be documented in the Study Report including HEC-RAS models, storm sewer analysis models, multiple-frequency water surface elevations, inundation areas/ floodplains, flood profiles, detailed plan component descriptions, cost estimates, and comparison rankings. The outputs will be presented in tables, exhibits, and GIS database layers. The exhibits will include subbasin Preliminary Improvement Layout (showing investigated improvement measures), Overall Proposed Recommended Alternative Layout Map, Individual Subbasin Recommended Alternative Layouts (showing proposed improvements, proposed floodplain and inundation depths, structures removed with damage reduction, and project cost). CSE will provide draft data to the City for review and comment prior to finalization. CSE will provide the City digital compilation of alternative analysis products.

#### **Task 10: Preliminary Environmental Assessment**

CSE will review and assess existing environmental constraints within the study area. This task will be focused on a desktop level GIS exercise of known environmental constraints relative to proposed structural flood reduction alternatives that are identified as part of this overall study. Information will be gathered such as biological resources (e.g. threatened and endangered species, species habitat, and protected areas), wetlands, national wetland inventory, hazardous materials (e.g. industrial hazardous waste locations, leaking petroleum storage tanks), water wells, gas/oil wells, pipelines, cultural resources, and socio-economic data. The information will be collected from previous and adjacent area reports and Texas Parks & Wildlife, US Fish & Wildlife Services, Texas General Land Office, Texas Historic Commission, Texas Commission of Environmental Quality, and Texas Railroad Commission. The intent of the environmental constraint investigation is to identify known environmental constraints and/or issues that may impact proposed alternatives or will be impacted by the proposed improvements. In addition, physical constraints such as highways and railroads will be included within the constraint inventory. This information will generally be used as a starting point for future Texas Water Development Board (TWDB) Flood Infrastructure Fund (FIF) Category 2 funding and will need to follow TWDB Category 2 Environmental Analysis standards. An Environmental Constraint Map will be developed for the study area and provided as an exhibit.

#### **Task 11: Benefit-Cost Analysis (BCA)**

A benefit-cost analysis (BCA) will be performed for the proposed alternative plans and benefit-cost ratio (BCR) must be quantified and reported. A BCR greater than 1.0 is frequently a requirement for state and federal financial assistance. The benefits may include a variety of items including, but not limited to property losses avoided, risk of injuries or fatalities prevented, and economic disruption or environmental losses avoided. The acceptable and available BCA methods include FEMA BCA Toolkit and the TWDB BCR Input Interface and Analysis Tool.

CSE will use the appropriate BCA toolkit based on key assumptions and parameters (e.g. project useful life, project cost, annual maintenance cost, lowest floor elevation, BFE, building information, occupancy, before-mitigation damages, after-mitigation damages, social benefits). CSE will develop estimated annual damages for with and without project conditions for the desirable level of protection design storm. As part of the analysis, structural inventory will be developed within ArcGIS as well as depth-damage curves for base and proposed conditions. The structure inventory will be based on available land use, parcel, and building data/GIS layers. Finish floor elevations shall be estimated based on a windshield survey of the structures within the project inundation areas in conjunction with the LiDAR topography. The BCA results will be documented within the technical report based on structures removed and damage reduced.

### **Task 12: Drainage Impact Fee Study / Stormwater Utility Fee**

CSE will review the City's existing drainage impact fee structure and update based on the resulting CIP improvement plan for the DMP. The maximum impact fees will be calculated for those improvements eligible for assessment of fees in accordance with state statutes. CSE will research other jurisdictions and municipalities that have implemented stormwater utility fees and develop a recommendation that fits the City.

### **Task 13: Capital Improvement Plan (CIP)**

A Capital Improvement Plan (CIP) will be developed. The purpose of the CIP is to give the City of Tomball a tool to plan future capital improvement expenditures for drainage systems. The CIP will identify the characteristics of proposed drainage modifications or improvements required for the drainage systems that are currently considered to be inadequate relative to the City's drainage criteria, detailed hydraulic analysis, and historical flooding complaints. The recommended CIP projects include drainage ditches improvements, stream crossing structures (bridges and culverts) replacements, storm sewer systems enlargements, and detention basins. The CIP projects will be prioritized according to the prioritization criteria system to be developed for the study.

### **Task 14: Review and Update Drainage Criteria and Standards**

CSE will review existing City drainage criteria based on latest methodologies and adjacent municipality criteria. Additionally, consideration of the DMP analysis results and proposed CIP will be integrated into the criteria requirements, design frequencies, and methodologies to maintain the future integrity of the DMP and future drainage needs. City drainage standards will be reviewed and proposed updates provided as well based on adjacent municipality standards, constructability, and maintenance issues and needs.

### **Task 15: Final Report**

CSE will prepare a Drainage Master Plan Report including narrative, assumptions, tables, figures, data, procedures, approach, analysis, modeling results, exhibits, photo logs, and estimates. The report will be prepared to present and summarize the various project development elements including existing flood control / drainage systems, drainage improvement projects underway or approved, existing flooding/drainage issues, 30-year future land protection and future conditions flood risks, identified critical and at risk infrastructures, topographic data development, H&H analysis including assumptions, parameters, calibration, and methodology, existing and proposed conditions H&H modeling analysis results, alternative (structural and non-structural) plan formulation / evaluation and recommendation, environmental assessment, easement requirement, benefit-cost analysis, floodplain and inundation mapping, phasing and implementation plan, funding alternatives, recommended drainage impact fee and stormwater utility fee structure, and drainage Capital Improvement Plan.

### **Task 16: Grant Applications**

CSE will assist the City of Tomball to prepare grant application documents required for various Federal and State grants for the proposed drainage improvements identified within the DMP. The grant agencies may include Texas Water Development Board (TWDB), Texas General Land Office (GLO) and Texas Division of Emergency Management (TDEM) as part of various grant programs. It is anticipated that a maximum of four (4) grant applications will be prepared as part of this study.

## EXCLUSIONS

- Professional Engineering design services for preparation of bidding and construction documents.
- Professional Land Surveying services for boundary and/or topographic surveying for final design, expected as noted in Task 4 to support analysis.
- Environmental Studies including wetland investigations, expect as noted in Task 10.
- Geotechnical Investigations.
- Subsurface Utility Investigations (SUE) and/or utility coordination, public or private with the exception of City available GIS data.

## SCHEDULE

City of Tomball Drainage Master Plan Study Timeline

	2023												2024									
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	
<b>0 CONTRACT MANAGEMENT</b>																						
COUNCIL AWARD																						
CONTRACT EXECUTION AND NTP																						
<b>1 PROJECT MANAGEMENT</b>																						
KICK-MEETING																						
PROJECT TEAM COORDINATION																						
AGENCY COORDINATION																						
BI-WEEKLY PROGRESS MEETING																						
MONTHLY PROGRESS REPORT																						
<b>2 PUBLIC OUTREACH</b>																						
STEERING COMMITTEE/ STAKEHOLDER MEETING																						
CPAC MEETING																						
PUBLIC HEARING/ PRESENTATION TO COUNCIL																						
<b>3 DATA COLLECTION AND REVIEW</b>																						
DATA COLLECTION AND ASSIMILATION																						
<b>4 FIELD SURVEY</b>																						
FIELD SURVEY																						
<b>5 GIS BASE MAPPING &amp; GEODATABASE DEVELOPMENT</b>																						
GIS BASE MAPPING																						
GEODATABASE DEVELOPMENT																						
<b>6 DEVELOPMENT OF HYDROLOGIC AND HYDRAULIC MODELS</b>																						
HYDROLOGIC MODELING																						
HYDRAULIC MODELING																						
<b>7 EXISTING CONDITIONS MODELING ANALYSIS</b>																						
EX FLOOD RISK ANALYSIS/ MAPPING																						
<b>8 FUTURE WITHOUT-PROJECT "NO-BUILD" CONDITIONS ANALYSIS</b>																						
EX FLOOD RISK ANALYSIS/ MAPPING																						
<b>9 ALTERNATIVE ANALYSIS</b>																						
ALTERNATIVE ANALYSIS																						
<b>10 PRELIMINARY ENVIRONMENTAL ASSESSMENT</b>																						
ENV ASSESSMENT OF ALTERNATIVES																						
<b>11 BENEFIT-COST ANALYSIS</b>																						
BENEFIT-COST ANALYSIS																						
<b>12 DRAINAGE IMPACT FEE &amp; STORMWATER UTILITY FEE ANALYSIS</b>																						
FUNDING/ FEE ANALYSIS																						
<b>13 CAPITAL IMPROVEMENT PLAN (CIP)</b>																						
CIP DEVELOPMENT & PRIOTIZATION																						
<b>14 REVIEW AND UPDATE DRAINAGE CRITERIA &amp; STANDARDS</b>																						
DRAINAGE CRITERIA UPDATES																						
DRAINAGE STANDARD UPDATES																						
<b>15 DRAINAGE MASTER PLAN REPORT</b>																						
DRAFT DMP REPORT																						
FINAL DMP REPORT																						
<b>16 GRANT APPLICATIONS</b>																						
PREPARE & SUBMIT APPLICATIONS																						



**PART B – BASIS OF COMPENSATION AND REIMBURSABLE EXPENSES**

**ENGINEERING & PLANNING PROJECT NO. 2023-10008**

**CITY OF TOMBALL  
DRAINAGE MASTER PLAN**

The following represents the estimated maximum compensation for the scope of services documented in Attachment A, Part A of this agreement. If services beyond those specifically identified are determined necessary during the project, Engineer shall not proceed with those services until such time written approval of the scope and any additional fees are approved by the City of Tomball.

The recommended budget for this scope of services is:

<b>PROJECT TASK ID</b>	<b>TASK DESCRIPTION</b>	<b>AMOUNT</b>	
1	PROJECT MANAGEMENT	\$38,000.00	
2	STAKEHOLDER OUTREACH AND AGENCY COORDINATION	\$24,000.00	
3	DATA COLLECTION AND REVIEW	\$24,000.00	
4	SITE INVESTIGATION AND FIELD SURVEY	\$38,000.00	
5	GIS BASE MAPPING & GEODATABASE DEVELOPMENT	\$48,000.00	
6	DEVELOPMENT OF HYDROLOGIC AND HYDRAULIC MODELS	\$172,000.00	
7	EXISTING CONDITIONS MODELING ANALYSIS	\$32,000.00	
8	FUTURE WITHOUT-PROJECT "NO-BUILD" CONDITIONS ANALYSIS	\$18,000.00	
9	ALTERNATIVE ANALYSIS	\$196,000.00	
10	PRELIMINARY ENVIRONMENTAL ASSESSMENT	\$12,000.00	
11	BENEFIT-COST ANALYSIS	\$28,000.00	
12	DRAINAGE IMPACT FEE & STORMWATER UTILITY FEE ANALYSIS	\$26,000.00	
13	CAPITAL IMPROVEMENT PLAN (CIP)	\$36,000.00	
14	REVIEW AND UPDATE DRAINAGE CRITERIA & STANDARDS	\$44,000.00	
15	FINAL DMP REPORT	\$60,000.00	
<b>SUBTOTAL</b>		<b>\$796,000.00</b>	<b>LUMP SUM</b>
16	GRANT APPLICATIONS (4 max) <i>Specified Rate Reimbursement</i>	\$48,000.00	T&M
<b>TOTAL</b>		<b>\$844,000.00</b>	

The recommended budget for this scope of services is \$844,000 (Not to Exceed).

Notes: 1. Reimbursable Expenses shall be invoiced and paid based on cost of service provided plus 10% markup. These services include travel, deliveries, postage, graphical reproduction, etc.

**ATTACHMENT "B"**

**INSURANCE**