



## **EXHIBIT A**

### **INTRODUCTION**

#### **BACKGROUND**

In August 2017, Hurricane Harvey struck the Texas coast, bringing a historic amount of rainfall to the Houston region. The storm produced never-before-seen precipitation depths in Galveston, Harris, and Brazoria Counties, as well as surrounding counties. As was the case with most of the watersheds in the region, Clear Creek and Dickinson Bayou experienced widespread flooding, which resulted in significant flood damages in the region.

#### **GOALS AND OBJECTIVES**

The goal of this study is to develop a comprehensive flood mitigation plan for the Lower Clear Creek and Dickinson Bayou watersheds. The study will identify vulnerabilities in the watersheds, then develop and refine concepts to reduce flooding.

Concepts may include one or a combination of the following:

- Detention Basin(s),
- Channel Modification(s),
- Channel Maintenance,
- Bypass Channel(s) including tunneled options,
- Pump Station(s),
- Property Buyout(s), and
- Others to be identified as part of the study.

Once developed, these concepts will be refined and potentially combined into actionable alternatives. The alternatives will be scored and ranked based on their benefit, cost, ability to implement, and community & environmental impacts to yield the most beneficial project(s) for Lower Clear Creek and Dickinson Bayou.

#### **PLANNING AREA**

The planning area will include the Clear Creek watershed within Galveston County beginning near Dixie Farm Road (Lower Clear Creek Watershed), and the Dickinson Bayou watershed within Galveston County.

#### **PLANNING PARTNERS**

There are numerous stakeholders along Lower Clear Creek and Dickinson Bayou, and League City will lead the engagement of partners critical to funding future phases and implementation. League City has entered into an agreement to receive Planning Assistance to States (PAS) funding in the amount of \$250,000 from the U.S. Army Corps of Engineers (USACE) under the authority provided by Section 22 of the Water Resources Development Act of 1974 (PL 93-251), as amended. This scope reflects USACE PAS

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### **Preliminary Scope of Services**

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participation in identified scope tasks, and specifically identifies USACE PAS Value Add Services that are not included in the Base Scope.

Key Planning Partners include:

- United States Army Corps of Engineers (USACE)
- City of Friendswood
- Harris County Flood Control District
- Galveston County Consolidated Drainage District
- Galveston County

Additional planning partners may include any or all of the following:

- Clear Lake Area Council of Cities
  - City of Nassau Bay
  - City of Clear Lake Shores
  - City of Seabrook
  - City of Kemah
  - City of El Lago
  - City of Taylor Lake
  - City of Webster
- City of Houston
- City of Dickinson
- City of Texas City
- City of Pasadena
- City of Pearland
- Brazoria County Precinct 3
- National Aeronautics and Space Administration (NASA)
- Houston Galveston Area Council (H-GAC)
- Bay Area Houston Economic Partnership (BAHEP)
- Texas Department of Transportation (TXDOT)
- United States Geological Survey (USGS)
- National Weather Service (NWS) River Forecast Center (RFC)

### **PROJECT PHASING & DELIVERABLES**

To maximize the effectiveness of the study, the effort will be divided into Phases. For all deliverables three (3) hard copies and one (1) electronic copy in a high-resolution PDF will be provided.

#### Initial Authorization

- Phase 1: Discovery & Baselineing
- Phase 2: Watershed Study
- Phase 3: Project(s) Identification

#### Future Authorization

- Phase 4: Implementation Plan



- Phase 5: Project(s) Preliminary Design
- Phase 6: Project(s) Detailed Design
- Phase 7: Project(s) Construction Management

This document includes a detailed proposal for Phases 1 through 3. Scope and fee for Phases 4, 5, 6 and 7 will be developed based on the outcome of Phases 1 through 3 to ensure the effort aligns with the expectations and needs of League City.

## **SCOPE OF SERVICES**

### **Project Management & Administration**

- I. **PROJECT MANAGEMENT, COORDINATION AND MEETINGS – This task is essential to ensure efficient project coordination and to achieve mitigation planning project objectives effectively.**
  - A. Project Management and Administration – Based on an estimated schedule of 18 months, the Project Manager will be responsible for project management and coordination services consisting of internal team management and subconsultant management, as well as regular communication with League City and the other planning partners. Specific tasks include:
    1. Internal project management including task leadership, internal communication, and data management as specified in the Project Management Plan (PMP).
    2. Subconsultant management and coordination including contracting, invoicing, review of deliverables, and communication.
    3. Administration of the contract, including preparation of invoices and progress reports on monthly basis and requests for authorization as needed. Authorizations will be based on the scope of services and justification will be provided as needed.
    4. Provide a schedule indicating tasks, critical dates, and deliverables, and prepare regular updates.
  - B. Kickoff Meeting – Attend the initial planning kickoff meeting to discuss planning goals and objectives, review the project schedule, and discuss deliverables and other relevant items. Meeting will be attended by the Project Manager and a Project Engineer at a minimum.
  - C. Monthly Project Coordination Meetings – Prepare for and attend a monthly project progress meeting with the project team (15 meetings). This includes preparation of the meeting agenda and any necessary meeting materials (maps, documents, etc.). Minutes documenting the discussion will be provided summarizing the discussion and action items. All meetings will be attended by the Project Manager and one (1) additional team member at a minimum. Meeting duration assumed 1 hour.
  - D. Bi-Weekly Conference Calls – Participate in bi-weekly coordination calls with League City. 30 minutes duration assumed. Monthly Project Coordination Meeting supersedes the Bi-Weekly call and both meetings will not be held in the same week.



- E. City Council Meetings – Prepare for and attend League City Council Meetings (2 meetings). This includes preparation of presentation materials as requested by League City staff. Meeting will be attended by Project Manager and Project Principal/Client Representative at a minimum. Meeting duration assumed 2 hours plus 1-hour pre-meeting with League City staff.
- F. Technical Advisory Panel – Assemble and oversee technical advisory panel including representation by all consultants working on flood mitigation projects within Clear Creek and Dickinson Bayou watersheds. Consultant representation shall include consultants involved with but not limited to the following projects: Clear Creek Federal Project, South Belt Detention Basin, Dagg Road Detention Basin, Mudd Gulley Channel Conveyance, HCFCD Potential Detention Basins near FM 528 and Dixie Farm Road, Galveston County Detention Basin near FM 517 and Dickinson Bayou, and City of Dickinson Local Drainage Projects. Technical Advisory Panel will meet quarterly at League City Hall. Meeting duration assumed to be 90 minutes.

***USACE Participation in Project Management and Administration:***

- **Project Management, Coordination and Meetings**
  - USACE will participate in regular monthly and bi-weekly project coordination meetings, key project milestone meetings and workshops, along with all stakeholder meetings that occur during the project duration. USACE may also provide coordination with other Federal agencies and stakeholders as identified to advance project goals.

**Phase 1 – Discovery and Baselineing**

- I. **DATA COLLECTION, REVIEW AND BASELINING – This task establishes the baseline conditions for the mitigation plan based on comprehensive information collected from various past flood events and studies within the watershed.**
  - A. Data Collection – Collect relevant items to be reviewed and utilized for planning. Data includes, but is not limited to:
    - Terrain Information (Updated LiDAR, available survey data, limited field survey including bridges and culverts)
    - Gage Information (HCFCD FWS, USGS, etc.) to include rainfall, WSEL, and Discharge (if applicable)
    - Historical High-Water Marks (HWM)
    - Existing models for Clear Creek and Dickinson Bayou
    - Precipitation Data – Multi-sensor Precipitation Estimate (MPE) rainfall from the NWS for three (3) events: e.g. Hurricane Harvey, TS Allison, and Hurricane Alicia. Other relevant events may be substituted based on input from League City.
    - Gage-Adjusted Radar Rainfall (GARR), for three (3) events to be provided by a subconsultant (Vieux, Inc.)
    - Storm Surge Data – Time-series storm surge elevations for the three (3) events will be utilized as the downstream boundary condition of the unsteady hydraulic models.

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### Preliminary Scope of Services

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- Historical flood records that can be provided by the planning partners
- Sedimentation data and reports for the Clear Creek and Dickinson Bayou Watershed
- Available reports detailing previous model development efforts and mitigation planning.
- Parcel data from appraisal district
- Existing and future land use information
- Flood complaint information

- B. Field Reconnaissance Visits – Conduct site visits along the Clear Creek main stem from the confluence with Galveston Bay to Dixie Farm Road and each of the major tributaries up to the Galveston County line to familiarize the project team with the conditions. Visits will also be conducted along Dickinson Bayou and tributaries within Galveston County Boundaries.

Site visits will focus on viewing the channel at major roadway crossings to document the conditions at the crossing as well as the channel conditions upstream and downstream. Site visits on tributaries will focus on areas near the confluence of the tributary and the main stem of Lower Clear Creek and Dickinson Bayou. Site visits to Clear Lake and the 2<sup>nd</sup> Outlet Structure will also be included to verify the configuration is consistent with the modeling.

- C. Document Field Reconnaissance Visits – Site visits will be documented in a field observation report that includes photographs and notes detailing findings.
- D. Model Evaluation and Data Review – Review the collected data and leverage the information provided to make recommendations for model updates. Specific tasks include the following:
1. Review all reports provided and determine additional data needs.
  2. Evaluate gage information for completeness and period of record as well as comparison to the historical HWM and flood complaint information to determine consistency.
  3. Evaluate available H&H models to determine additional model development needs for future phases.
  4. Evaluate available terrain information for future modeling and mapping purposes.
- E. Prepare Model and Data Collection Summary Report - Prepare and submit Summary Report documenting data collected and reviewed and model data analyzed.
- F. Locate Critical Infrastructure – Provide an exhibit and related GIS shapefile that locates critical facilities along Lower Clear Creek, Dickinson Bayou and tributaries in study area. This could include hospitals, government buildings, water and wastewater treatment facilities, police and fire stations, schools, major utility crossings, and others.
- G. Develop Damage Curves - Using parcel data obtained from the appraisal district, overlay latest LiDAR topography and aerial photography and develop GIS point dataset of structures, and develop estimated structural finished floor elevations based available data including Google StreetView, USACE Federal project studies, or other data accounting for typical slab elevation adjustments. Develop damage curves (flood height versus damage cost) for areas within the

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Clear Creek and Dickinson Bayou study area. Structural Inventory Data from HCFCF will be used as available.

- H. Review Ongoing Clear Creek Projects – Review the USACE Clear Creek Federal project. In addition, review planned improvements to Clear Creek as part of the 2018 Harris County Bond Program. FNI will use existing modeling of planned improvements to identify relative WSEL change at Clear Creek & Dixie Farm Road and Clear Creek & Interstate 45 as a result of these improvements. It is assumed that modeling of planned improvements has been completed and will be available for use in this task.
- I. Prepare Existing and Planned Condition Summary Memo - Prepare and submit brief technical memo for Clear Creek and Dickinson Bayou identifying future projected conditions (including Annual Flood Damage Assessment from USACE report) to Lower Clear Creek study area from planned work on Clear Creek by USACE and HCFCF.
- J. Existing and Planned Condition Summary Workshop - Meet with League City to discuss the conclusions from the Existing and Planned Condition Summary Memo. Field Reconnaissance Visits and Model and Data Collection Summary Report will also be discussed. City comments will be solicited and addressed.
- K. Task Deliverables
  - 1. Catalog of Data Collected including name, date, and source of information
  - 2. Field Observation Reports for site visits
  - 3. Summary of reports and data reviewed
  - 4. Existing and Planned Condition Summary Memo
  - 5. Exhibit and GIS Shapefile for critical facilities and infrastructure

#### ***USACE PAS Participation in Phase 1, Task 1:***

- **Data Collection, Review and Baselineing**
  - USACE will provide data collection assistance including but not limited to: previous studies, hydrologic and hydraulic models (including both riverine and coastal model data), depth-damage curves, survey data, and field reconnaissance.
- ***USACE PAS Value Add Services in Phase 1, Task 1 (Not Included in Base Scope)***
  - **Bathymetric Survey**
    - USACE will provide bathymetric survey data at key locations in the study area to define channel geometry below normal water surface elevations and identify areas of concern with regards to erosion and sedimentation.

- II. **PLANNING PARTNER ENGAGEMENT – Due to the significant number of stakeholders along Clear Creek and Dickinson Bayou, early engagement of Planning Partners for their support and project participation is critical to project success.**

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- A. Coordination with Dickinson Bayou and Clear Creek Watershed Steering Committee – Prepare an agenda item for the February 2019 Steering Committee meetings and all subsequent bi-monthly meetings until scope of work is completed to present the Flood Mitigation Plan for Lower Clear Creek & Dickinson Bayou and inform Planning Partners present. Agenda items may include PowerPoint presentation and handouts. Materials presented will be at the direction of League City. Meeting will be attended by the Project Manager at a minimum.
- B. Coordination Meeting with Planning Partners – Attend up to three (3) meetings per watershed (6 total) with Planning Partners. Meetings may be with individual partners or with multiple partners simultaneously. Meeting agenda will include informing partners on progress, seeking buy-in to publicly and financially support project, seeking available data and project information and other items at direction of League City. Meeting will be held in League City at League City's direction.
  - 1. Prepare a PowerPoint presentation as well as necessary exhibits for the meetings. Draft versions of both the presentations and materials will be provided to League City for review and comments. Make adjustments to the materials based on comments.
  - 2. Participate in one (1) pre-meeting with League City Staff prior to each Coordination Meeting. These meetings are intended to discuss the presentation and exhibit content as well as to review the findings to be presented.
- C. Task Deliverables
  - 1. Agenda Items and PowerPoint Presentation for Watershed Steering Committee Meetings
  - 2. Presentation, exhibits and agenda for Planning Partner Meetings
  - 3. Planning Partner meeting minutes

#### ***USACE PAS Participation in Phase 1, Task 2:***

- **Coordination Meeting with Planning Partners**
  - USACE will participate all stakeholder meetings that occur during the project duration. USACE may also provide coordination with other Federal agencies and stakeholders as identified to advance project goals.

### **III. EVALUATE FUNDING OPPORTUNITIES FOR ENGINEERING SERVICES**

- A. Meetings with Potential Funding Partners – Project team shall facilitate and attend meetings with representatives from League City with potential funding partners. Attend up to three (3) meetings. Meeting handouts and agendas will be prepared by team but use of PowerPoint slides (in addition to slides developed for other meetings) is not assumed.
- B. Preliminary Funding Opportunity Report - Prepare a report outlining possible Federal and State grant and/or loan funding sources available for the preparation of the plan and design of potential resultant projects. Possible Federal sources may include Federal Emergency Management Agency (FEMA) Hazard Mitigation Grant Program (HMGP), Public Assistance



(PA) and Flood Mitigation Assistance (FMA) grant programs; U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant (CDBG) programs; and Texas Water Development Board (TWDB) Flood Protection grant program (FP), Clean Water State Revolving Fund (CWSRF) low-interest loan and grant program, and the Texas Water Development Fund (Dfund) loan program.

**C. Task Deliverables**

1. Funding Partner Meeting handouts, exhibit and presentation materials
2. Preliminary Funding Opportunity Report

**Phase 2 - Watershed Study**

**I. DEVELOP HYDROLOGIC MODELS - Develop hydrologic models for the Study Area using available hydrologic data as available to provide an improved baseline condition.**

A. Hydrologic Analysis – Separate hydrologic models for Lower Clear Creek and Dickinson Bayou will be created using the USACE HEC-HMS hydrologic model. The model will be developed to utilize consistent precipitation, loss parameters, and hydrograph transform parameters. Existing detailed models provided by HCFCDD will not be updated outside of the study area limits. Specific tasks include:

1. Hydrologic Model Development – Develop a comprehensive hydrologic model to be utilized in conjunction with the hydraulic assessment.
  - a. Subdivide or combine drainage areas to ensure adequate computational points and consistency with the existing gage network. Drainage areas within the study area will be delineated such that major changes in discharges are captured at tributary confluence as well as significant hydrologic features such as bridges, culverts, detention basins, major outfalls, and other features.
  - b. Develop hydrologic loss and transform parameters using a consistent methodology. The new hydrology will utilize the Initial and Constant loss method and the Clark UH transform method. HCFCDD loss parameters will be utilized for this task.
  - c. Develop precipitation data based on NOAA Atlas 14 rainfall dataset.
  - d. Execute models for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year storms along with the three (3) historical events and review/compare the results to the effective discharges and historical gage data (where available)

**B. Task Deliverables**

1. Technical memorandum detailing the methodology, development, and results of the existing conditions modeling effort including related exhibits and results tables
2. HEC-HMS Models
3. GIS data supporting modeling efforts in geodatabase format





4. Supporting parameter calculation spreadsheets or other related files

**II. FLOOD HAZARD ASSESSMENT – With updated hydrologic data, develop hydraulic models and perform flood damage assessment for existing conditions.**

- A. Hydraulic Analysis – Develop unsteady-state 1D/2D HEC-RAS hydraulic models to reflect flood risk on Clear Creek and Dickinson Bayou main stems and major tributaries within Galveston County. Limited detail hydraulic models will be developed based on data provided by cities and 2018 LiDAR for unstudied tributaries.

Models will be developed leveraging available data sources as available, including: existing effective steady state models, USACE Federal Study modeling, and existing planning level unsteady modeling. Existing modeling will be leveraged as much as is deemed appropriate.

1. Unsteady State Hydraulic Analysis – Develop unsteady state 1D/2D HEC-RAS models for Lower Clear Creek and Dickinson Bayou within the study area.
  - a. Develop models to reflect most current terrain data and field survey
    - i. Adjust cross section alignments and update elevations from the terrain data. The hydraulic models will be updated using the most recent terrain within the study area.
    - ii. Add bridge and culvert crossings as needed to the models within the study area. These will be based on field survey data where it is available or field observation and measurements if survey data is unavailable.
  - b. Develop model geometry and 2D mesh (where applicable), including roughness values, obstructions, breaklines, and ineffective flow areas as-needed based on site visits, aerial imagery, land use data, and building footprint information. 2D mesh grid cell size will be of sufficient resolution to identify flood risk at the parcel level.
  - c. Using flow data developed in the Hydrologic Analysis task, apply inflow hydrographs to the hydraulic model. Consideration for inflow hydrograph and boundary condition locations will include (at a minimum) roadway crossings where there are currently gages or future potential gage locations, confluences of tributaries, or other locations where there are significant changes in stormwater discharge when inflow hydrographs are applied.
  - d. Execute the models for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year storms along with the three (3) historical events and review/compare the data to the effective modeling and HWM data (where available). It is understood that the development of the combined unsteady models will require multiple run iterations for each of the streams to construct a stable model.



- B. Model Calibration – Utilize the gage data, HWMs, and modeled historical storms to evaluate the validity of the existing conditions hydraulic models and adjust model parameters to achieve consistent results between the models and observed data.
  - 1. Document and compare total volume, peak discharges, hydrograph shape, and calculated WSEL for each of the historical storms in the unsteady hydraulic model vs. the observed gage data at gages and other HWM locations.
  - 2. Document model parameter adjustments required to achieve calibration.
- C. Flood Hazard Assessment
  - 1. Prepare inundation mapping for the 100- and 500-year events on Lower Clear Creek and Dickinson Bayou. Mapping will be based on RAS Mapper; no additional editing or cleanup will be performed on the mapping. Depth grids and velocity grids will also be developed.
  - 2. Prepare water surface profiles for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year storms
  - 3. Provide comparison tables of the calculated WSEL to the effective modeling (if applicable) to show the changes and provide a discussion of any significant changes.
  - 4. Determine single-event and expected annual damages for at-risk structures for events up to and including the 500-year (0.2% annual exceedance probability) storm event.
  - 5. Identify Transportation System Impacts – Determine major roadway accessibility during flood events and evaluate potential evacuation routes.
    - a. Identify major roadways and the extent of the roadway that overtop for the modeled storm events
    - b. Using the modeling and gage information, set critical gage elevations where inundation at nearby road crossings is likely
    - c. Identify evacuation routes along major roads based on frequency of inundation and traffic capacity.
    - d. Consider potential improvements to major roadways that could reduce the risk of inundation and provide a more reliable evacuation route. Recommendations for this task will be limited to identifying crossings that should be raised. Include related exhibits and tables identifying evacuation routes for multiple rainfall frequencies.
- D. Task Deliverables
  - 1. Technical memorandum detailing the methodology, development, calibration, and results of the existing conditions modeling effort including related exhibits and results tables
  - 2. HEC-RAS Models
  - 3. GIS data supporting modeling efforts in geodatabase format
  - 4. Inundation mapping including depth and velocity grids in geodatabase format
  - 5. Gage information for historical storms



6. Supporting parameter calculation spreadsheets or other related files
7. Annual Flood Damage Assessment Technical Memorandum
8. Transportation Impact & Evacuation Route Memorandum

**III. FUTURE FLOOD RISK PLANNING ASSESSMENT – This task projects future developments in the watershed, defining future/potential risks requiring mitigation and basis for potential mitigation projects.**

- A. Assessment of future growth conditions – Update the existing conditions models developed in Task II to estimate a future condition within the watershed if no new flood mitigation measures were pursued. Future conditions will be estimated by utilizing available population growth projections, and regional growth/development patterns, drainage criteria that has been adopted by appropriate relevant agencies within the watershed, and other information as available. Consideration of the future condition analysis will aid in the evaluation of long-term flood hazard mitigation measures.
  1. Freese and Nichols 2017 Land Use Assumptions Report will be used to define future land use conditions within the study area. Convert estimates of future development into gridded data of land use
  2. Update hydrologic parameters in the hydrologic model to reflect future conditions. Parameters to be updated include percent impervious, and Tc+R. Modifications will be consistent with drainage criteria adopted by regulatory agencies within the study area
  3. Execute HEC-RAS models with future conditions hydrology and update inundation maps for 100- and 500-year events
- B. Task Deliverables
  1. Technical memorandum detailing the methodology, development, and results of the future conditions modeling effort including related exhibits and results tables.
  2. Final models
  3. GIS data supporting modeling efforts in geodatabase format.
  4. Inundation mapping including depth and velocity grids in geodatabase format
  5. Supporting parameter calculation spreadsheets or other related files.

**IV. WATERSHED STUDY SUMMARY & PROJECT DEFINITION – This task will aggregate all reports prepared during this phase and set the stage for Phase 3 by defining project goals and evaluation criteria.**

- A. Prepare Summary Report – Summary report will include an executive summary of all of materials prepared during the phase. Appendix will organize all technical memoranda prepared during this phase.
- B. Watershed Study Summary & Project Definition Workshop – Meet with League City and other stakeholders at direction of League City to discuss the conclusions from the Watershed Study Summary Report. City comments will be solicited and addressed.



Workshop will also seek to provide project definition by making determinations on the desired level of service (storm event) Clear Creek and Dickinson Bayou flood risk reduction projects should provide in the project area. Included in this discussion will be screening criteria for concept evaluation purposes. Criteria will consider metrics such as hydraulic performance, project cost, design life, annual flood damage reduction, maintenance, feasibility, constructability, public benefit, environmental impact, and public safety.

**C. Task Deliverables**

1. Watershed Study Summary Report
2. Level of Service for Project(s)
3. Screening Criteria

***USACE PAS Value Add Services in Phase 2 (Not Included in Base Scope):***

- **Compound Flooding Analysis**
  - USACE will provide guidance and technical assistance with regards to Compound Flooding Analysis, including probabilistic techniques and historical storm data to determine appropriate boundary conditions for both coastal and riverine analysis.
- **Storm Surge Modeling**
  - USACE will perform additional storm surge analysis as-needed and/or provide relevant storm surge model data as it is developed for other USACE coastal projects to better inform boundary conditions and potential impacts from coastal storm surge.
- **Sea Level Rise**
  - USACE will provide guidance and relevant data with regards to sea level rise projections and procedures for evaluating potential impacts due to changes in sea level and subsidence.
- **Technical Assistance & Agency Review**
  - USACE will provide technical assistance as-needed including development of updated depth-damage curves, review of project deliverables, and guidance with regards to pertinent USACE engineering criteria.
- **Meetings**
  - USACE will participate in key project milestone meetings and workshops that occur during the project duration.

**Phase 3 – Project(s) Identification**

- I. **DEVELOPMENT OF PRELIMINARY CONCEPTS – Identify potential structural changes along Lower Clear Creek and Dickinson Bayou that have a significant impact on the WSEL.**



- A. Develop Preliminary Concepts - Develop preliminary concepts to meet requirements of flood risk reduction Project Definition for each watershed. Unsteady hydraulic models developed in Phase 2 will be used to evaluate potential benefits of conceptual level flood risk reduction projects as defined below. Concept development will include conceptual siting and sizing, order of magnitude cost and adequate detail to evaluate with screening criteria developed.
  1. Concepts may include standalone features or integrated solutions including the following:
    - a. Detention Basin(s) – Regional and/or Local
    - b. Channel Modification(s) – Vegetation clearing, de-silting, bank stability, straightening, widening, deepening, bridge modification/removal
    - c. Bypass Channel(s) – new channel to provide additional conveyance, includes underground conduits (tunnels)
    - d. Pump Station(s) – stand alone or in concert with other concepts
    - e. Property Buyout(s)
    - f. Others to be determined later
  2. Identify project ROW needs, environmental constraints, utility challenges, and other potential issues that may hinder implementation
  3. Prepare conceptual level opinion of project costs. The cost opinions will represent order of magnitude costs consistent with the level of effort and will be based on Freese and Nichols project experience.
  4. Prepare Preliminary Concept Technical Memorandum to summarize concept features including all analysis completed as part of this task. Each project identified will be discussed in a separate section.
- B. Score & Rank Concepts
  1. Score concepts based on the screening criteria developed in Phase 2, Task IV.B.
  2. Conduct workshop with League City and other stakeholders at League City's direction to review concept screening results. Adjust scoring if necessary to reflect input received.
  3. Rank the concepts and identify the top tier (three to five) concepts for each watershed for further development as alternatives based upon screening criteria defined in previous task. Alternative development will include more detailed H&H evaluation and benefit-cost evaluation.
  4. Prepare Preliminary Concept Scoring Technical Memorandum - Memorandum will summarize scoring and ranking of each preliminary concept.
- C. Task Deliverables
  1. Preliminary Concept Technical Memorandum
  2. Preliminary Concept Scoring Technical Memorandum



**II. REFINEMENT OF ALTERNATIVES – Refine concepts into alternatives. Conduct more detailed H&H evaluation of project alternatives and benefit-cost evaluation to inform project recommendations.**

- A. H&H Analysis – Refine top tier concepts into alternatives. Evaluate the effectiveness of the alternatives (three to five) for each watershed in the unsteady hydraulic models by identifying impacts to flows, WSELs, and inundation limits. Changes in peak flows and WSEL will be evaluated throughout the entire model to ensure no adverse impacts.
  - 1. Identify number of properties removed from floodplain and reductions in flood impacts at critical roadway locations relative to evacuation and emergency responder access.
- B. Benefit Cost Analysis
  - 1. Estimate expected annual flood damages for the proposed alternative scenarios for comparison with the existing and future conditions; the analysis will utilize a simplified approach based on single-event damages times expected annual exceedance probability. Damage curves developed as part of Phase 1 will be used.
  - 2. Refine construction costs prepared for preliminary concepts.
  - 3. Perform benefit cost analysis.
  - 4. Prepare memorandum summarizing results of analysis.
- C. Task Deliverables
  - 1. Refined Alternative Benefit Cost Analysis

**III. CONSTRUCTION PROJECT FUNDING OPPORTUNITIES – based on developed project alternatives revisit the funding opportunities investigated in previous phases to identify tailored funding sources based on project details.**

- A. Meetings with Potential Funding Partners – Project team shall facilitate and attend meetings with representatives from League City with potential funding partners. Attend up to three (3) meetings. Meetings handouts and agendas will be prepared by team but use of PowerPoint slides (in addition to slides developed for other meetings) is not assumed.
- B. Construction Funding Opportunity Report - Prepare a report outlining possible Federal and Texas-state grant and/or loan funding sources available for construction of project(s). Possible Federal sources may include Federal Emergency Management Agency (FEMA) Hazard Mitigation Grant Program (HMGP), Public Assistance (PA) and Flood Mitigation Assistance (FMA) grant programs; U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant (CDBG) programs; and Texas Water Development Board (TWDB) Flood Protection grant program (FP), Clean Water State Revolving Fund (CWSRF) low-interest loan and grant program, and the Texas Water Development Fund (Dfund) loan program.
- C. Task Deliverables



1. Project(s) Alternative Funding Opportunity Report
2. Funding Partner Meeting Handouts and Agendas

**IV. ALTERNATIVE RECOMMENDATION & PRIORITIZATION – based on the results of alternative analysis, H&H analysis, benefit cost analysis and funding opportunity investigation provide a recommendation to League City on the most actionable project(s) of the alternatives for each watershed advanced from previous task.**

**A. Score & Prioritize Alternatives**

1. Score alternatives based on the screening criteria including benefit cost analysis and funding opportunities
2. Conduct workshop with League City and other stakeholders at League City's direction to review alternative prioritization results. Adjust scoring if necessary to reflect input received.

**B. Project Recommendation Report - Prepare report describing projects recommended for preliminary design. Report will include recommended next steps including scope of work for further project development and implementation plan (Phase 4).**

**C. Task Deliverables**

1. Project Recommendation Report

***USACE PAS Value Add Services in Phase 3 (Not Included in Base Scope):***

- **Sea Level Rise**
  - USACE will provide guidance and relevant data with regards to sea level rise projections and procedures for evaluating potential impacts due to changes in sea level and subsidence.
- **Technical Assistance & Agency Review**
  - USACE will provide technical assistance as-needed including development of updated depth-damage curves, review of project deliverables, and guidance with regards to pertinent USACE engineering criteria.
- **Coordination and Meetings**
  - USACE will participate in key project milestone meetings and workshops. USACE may also provide coordination with other Federal agencies and stakeholders as identified to advance project goals.



### **Phase 3 – Project(s) Identification – Supplemental Services Allowance**

The following services are authorized as an allowance but require approval of League City prior to commencing work.

- I. PRELIMINARY DESKTOP GEOTECHNICAL EVALUATION – Evaluate geotechnical conditions for project concepts to inform feasibility and alternative evaluation. Evaluation will be desktop-based, relying on existing geotechnical information in project area. Field investigation, drilling and testing is not included.**
  - A. Preliminary Geotechnical Desktop Memo – Memo shall identify regional geologic and hydrogeologic conditions affecting concept feasibility. Subsections of report will discuss each concept individual and specific geotechnical conditions applicable to it. Report shall include an appendix summarizing
  - B. Task Deliverables
    1. Preliminary Desktop Geotechnical Memo
- II. PRELIMINARY ENVIRONMENTAL DESKTOP ANALYSIS – Evaluate environmental conditions for project concepts to inform feasibility and alternative evaluation. Evaluation will be desktop-based, relying on existing information in project area. Field investigation, sampling, drilling and testing is not included.**
  - A. Preliminary Environmental Desktop Memo – Memo shall present review of available environmental information such as, but not limited to, GIS data including National Wetlands Inventory; hazardous and contaminated sites; hydric soils mapping; USGS topographic maps; threatened, endangered, species of concern; designated critical habitat shapefiles and databases; and an on-line cultural resources review.
  - B. Task Deliverables
    1. Preliminary Environmental Desktop Memo
- III. COMMUNITY OUTREACH AND EDUCATION – Provide community outreach and education to assist the City in communication about the project with property owners, businesses, schools, and neighborhood associations; correspondence regarding the project; and facilitating stakeholder engagement and feedback for the project.**
  - A. Community Engagement Plan – Meet with the City to develop a community engagement plan. The plan document defines goals, objectives, key messages, target audiences, issues under consideration, tools/methods and schedule.
  - B. Community Education – Assist with the development of educational materials including, but not limited to, the following:
    1. Preparing basic exhibits showing the contributing drainage area and streams, inundation mapping based on the effort completed, roadway crossings, etc.





2. Prepare narratives for educational materials which provide a general description of the watershed characteristics, area, history of flooding, intent of the flood mitigation plan, etc.
  3. Provide graphics for websites, social media, and video preparation.
  4. It is understood that League City will provide guidance and the ultimate decision about what material is presented in the educational materials.
- C. Newsletters/FAQ/Project Brochure - Develop a newsletter, fact sheet or brochure to inform stakeholders throughout the project process. Each piece can be prepared initially but modified and updated through the project's progression. It is assumed that newsletters would be developed and issued no more than quarterly (every 3 months).
- D. Public Meetings - Will conduct two (2) public meetings. The purpose of public meetings is to encourage feedback and input on issues in the watersheds and well as feedback on preliminary concepts and alternatives. Level of effort for this task includes:
1. Meet with the City to identify desired outcomes
  2. Prepare meeting agendas and materials
  3. Create and distribute meeting announcement
  4. Manage logistics
  5. Facilitate and attend meetings
  6. Compile documents (sign in sheets, comment cards, etc.)
  7. Prepare and distribute meeting summaries
- E. Task Deliverables
2. Community Engagement Plan
  3. Community Education Materials
  4. Project Newsletter(s)
  5. Public Meeting preparatory, presentation and documentation materials

## **FUTURE AUTHORIZATION**

### **Phase 4 – Implementation Plan**

### **Phase 5 – Project(s) Preliminary Design**

### **Phase 6: Project(s) Detailed Design**

### **Phase 7: Project(s) Construction Management**