Hydrology and Hydraulics

West Fork Trinity River/East 1st Street Bridge Hydraulic Analysis/City of Fort Worth Engineering Department

Adapted HEC-2 model and combined LRD-1 model to form the base model. Hydraulic analyses of available options for the bridge structure, span, and grading in order to meet local, state, and federal requirements including the Texas Historical and US Army COE Commission performed.

West Fork Trinity River Sump #30 Drainage Study - Waste Management of North America, Inc

Potential for developing a 60,000 square foot building pad and a 15-acre parking lot utilizing HEC-1, NUDALLAS and other hydraulic principles for the project in Fort Worth, Texas evaluated. Post development flood plain elevation within the site managed through additional pumping and storage.

Chelsea Creek Drainage Study - Colleyville, TX

Detailed hydrologic and hydraulic evaluations of Chelsea Creek performed. Recommendations made to reduce the risk of flooding the homes along the creek north of Glade Road in Colleyville, Texas. Economic analyses also performed for various elements of the $1.3 million project.

Amity Village Drainage Improvements - Corinth, TX

Studied the historical flooding problems and projected hydrologic parameters based on various frequency rainfall events. Prepared conceptual design alternatives and cost projections for the City's consideration. Hydraulic elements and remedial measures of detention-pumping facilities, culverts, channels, and storm drainage system designed. Needed system capacity maximized within the constraints of the physical and economical concerns.

Drainage Master Plan - Copperas Cove, TX

Worked closely with City staff to develop a Comprehensive Storm Drainage Design Manual and citywide plan for the three major drainage basins. Project included cost, projections, and a timetable for implementing the adopted improvements, which included drop structures, channel, and bridge and culvert projects.

Flood Insurance Study Review - Greenville, TX

Reviewed, updated, and revised the Flood Insurance Study for the City of Greenville. Served on committee and made recommendations for channel improvements and detention pond policy to alleviate flooding problems.

Drainage Improvements - Pinehurst Lane - Grand Prairie, TX

The general scope of professional engineering services consisted of performing hydrological analysis; determining the hydraulic characteristics of the existing channel; and, identifying the cost-effective alternative for channel and slope protection. Plans and specifications were prepared for placing gabion systems along the channel bottom and slopes and the outfall's "headwall" reinforced concrete structure.

Other tasks included: detailed modeling of hydraulic jump and stilling basin; computing forces acting on the Stream bed and banks; engineering design surveys; preparing site grading and erosion control plans; analyzing required anchoring systems; construction observations; and, general project coordination with city personnel.

Shops at Highland Village – Highland Village, TX

Developed the Hydrological Model of the regional detention pond of approximately 15 ac. ft. Performed design computations for outlet configurations and prepared construction plans for an R-Rap Wall System to stabilize embankment. Project also included design of underground storm drainage pipes and culverts ranging in size from 24" XCP to 10 x 10 MBC; as well as a second detention facility under the parking lot. Evaluated and recommended well makeup water for the retention pond and site irrigation. Further structural measures were considered for the support of the box culverts discharging into the detention pond. Picture illustrates the outlet structure of the pond..

Glenwood Creek – Fort Worth, TX

Performed flood mitigation alternatives analyses through the development of comprehensive hydrologic and hydraulics models and provided engineering solutions to eliminate existing flooding issues along Glenwood Creek.

We evaluated existing conditions and future developments scenarios utilizing hydrologic model (HEC-HMS) and hydraulic modeling (HEC-RAS) for current and proposed neighborhood storm drainage networks and natural channels. We studied in detail the effects of detention on peak discharges and requirements for infra structures improvements leading to the development of a Benefit Cost Analyses (BCA) for the selected four viable alternatives. These alternatives included various combinations of detention, open channel, bridge, culvert and storm drainage improvements.

Storm Drainage System Analysis - Flower Mound, TX

Reviewed available hydrological models and projected drainage structure requirements for the current, 10-year, and 20-year horizons. Prepared cost projections for structural measures, and made recommendations for non-structural measures for this project in Flower Mound, Texas.

Newport Village – Fort Worth, TX

The City of Fort Worth required that the developer for Newport Village (private development) provide hydrological and hydraulic data to assure that the new land development adjacent to Boyd Branch (tributary to the Trinity River) would not cause a rise in the established 100-year floodplain water surface elevation (WSEL). JEA HydroTech was engaged to perform 100-year floodplain studies that involved preparing a LOMR to document the effects of the *as-built* channel, along Boyd Branch, in response to the previously approved CLOMR of 2006. The LOMR documents show that no rise in the WSEL will occur. As part of the scope of professional services, JEA HydroTech prepared a USACE Section 404 permit and a floodplain reclamation report addressing channel re-alignment, trees, wetlands and wildlife.

Other professional services involved performing topographic surveys and evaluating the available HEC- RAS numerical models. Additional changes to the project warranted preparing site specific Section 404 permit documents and purchasing stream credits from a mitigation bank.

HEC-2 and HEC-RAS numerical models were developed for baseline (pre-project condition) and proposed (post-project conditions) to evaluate the effect of the improvements. Several scenarios were considered including in-stream water ponding and islands to provide wildlife habitat in the original section 404 permit and the Conditional Letter of Map Revision (CLOMR). Further revisions were necessitated when a maximum conveyance trapezoidal channel was constructed to protect from potentially eroding and undermining the retaining wall that was constructed along the edge of the floodplain.

Bramlette Elementary School – Longview, TX

Floodplain hydraulic modeling was performed utilizing HEC-RAS for the pre-existing channel and proposed improved earthen channel which was designed as part of the reclamation project. A portion of the overbank and floodplain area was needed for expansion of the school, access road, and additional parking. Initially, a Conditional Letter of Map Revision (CLMOR) was secured for the project and ultimately a Letter of Map Revision (LOMR) was obtained upon the conclusion of the construction activities.

Como/Armstrong Hydraulic Analysis - Fort Worth, TX

Integrated water system models for the Holly, South II, South III, WEST II, and West III Pressure Planes in Fort Worth, Texas. Evaluated the effects of removing the COMO ground storage tank from the system, and provided recommendations on how to offset loss of tank during maintenance operations.

Flood Insurance Rate Maps Update – Greenville, TX

Updated the Flood Insurance Rate Maps for the City of Greenville. Assignment involved a review of the levels of development within the watersheds; refinement of the hydrological data and models (NUDALLAS, HEC-1); backwater modeling and water surface elevations determinations for 10, 50, 100 and 500 year storms (HEC-2); and mapping the floodplain data on aerial topography. The project further expanded to include serving on the Mayor's storm drainage advisory committee along with Citizens and Staff to make recommendations on establishing storm drainage guidelines for future developments requiring detention for flows that would exceed those generated from single-family residential developments. Further modeling and recommendations for upgrading the City's culverts and bridges at locations identified with conveyance issues were performed so that a sound Capital Improvements Program could be planned and implemented. Other aspects of these assignments consisted of representation at Public Hearings and interaction with the media and concerned citizens as well as FEMA.

Leslie Creek – Fort Worth, TX

Pre Prepared Microsoft Excel Spreadsheets for Leslie Creek to evaluate split flow of storm water runoff through conduits and channels. These spreadsheets were essential to compute the headwater elevations at the entrance of a complex culvert based on known discharges resulting in the development of a rating table for use in the HEC-RAS flow diversion computations. This effort was necessary to overcome the limitations of the HEC-RAS software capabilities. The methodology was based on widely accepted engineering hydraulic principles and utilized numerical techniques facilitated by the spreadsheet capabilities. The geometry of the conduit could be specified through depth-spread relationship for irregular sections; or multi box culvert parameters for standard sections.

The computational scheme divided the conduit reach into eight (8) segments and performed backwater computations based on backward step computations (a numerical solution adapted from backward differences finite difference approximations) using Manning's flow formulas. The computational scheme was simplified by eliminating supercritical flow from consideration. Only subcritical flow was considered starting at the downstream "boundary" conditions. The upstream conditions for each subdivided segment were computed and the resulting values were in-turn used as the downstream boundary condition for the next culvert reach.

Two "master" spreadsheets for the "lower" and "upper" segments were developed to "DRIVE" the computations and connect the individual computational sheets "L-1 through L-8 and U-1 through U-8" thus automatically eliminating manual data entries to individual sheets.

Pine Tree ISD Football Stadium – Longview, TX

Our professional contribution as part of the design team for the Pine Tree ISD Football Stadium included the coordination and design of the storm water collection, conveyance and discharge system for the ultimate site configuration as well as the interim system for the initial phase. Hydrologic and hydraulic computations were based on a 25 year storm with special considerations to maintain the hydraulic grade line of the pipes draining the playing field below the field subgrade, as they were combined with the offsite and onsite systems including drives and parking. Two outfall areas were evaluated and the drainage basins adjusted for post development flows so as not to overload the existing outfall structures or exceed pre developed peak flow rates utilizing detention where available. Prepared Construction documents with supporting computations and plan-profile sheets for approximately 26 inlets and 3500 feet of storm drain pipes. Concrete box culverts were used to dissipate the energy at the outfall and reduce the velocities below the erosive threshold.

Luxury Auto Park Addition – Frisco, TX

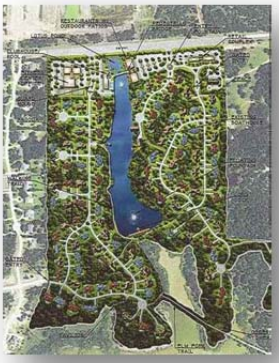
Performed detailed hydraulic evaluation of the detention pond outlet structure. Allowable release rates were based on the computed undeveloped peak flowrates resulting from the 2, 5, 10, 50 and 100 year storms.

Developed HEC-RAS model to analyze the hydraulic behavior of the storm water system as follows.

- Downstream water surface elevations were computed based on slope area method.
- The 42” diameter storm drain pipe was evaluated as a culvert to compute the headwater elevations at the culvert entrance.
- The backwater computation through the outlet structure, constriction and pond were used to develop the pond water surface elevations for various configurations.
- Additional issues relating to high velocities were resolved through the design of a baffle stilling basin.

Long Lake - Corinth, TX

Services provided for the 130 acres mixed use development.

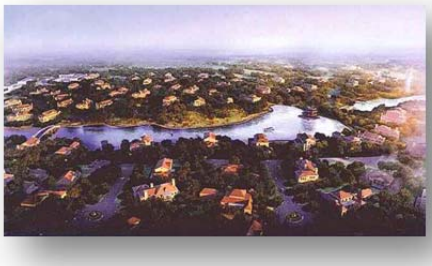


Drainage Design Overview

Coordinated with design team and reviewed proposed drainage design concept, methodology, and computations. Provided assistance and representation relative to meetings with TXDOT, US Army Corps of Engineers, City Staff and neighboring properties.

Dam and Spillway Design

- Evaluated dam and spillway against TCEQ standards and general engineering safety concerns and provided design of "reinforced earth" embankment.
- Verified that the TCEQ classification for this structure is "Low Hazard" which requires it to safely pass 25% of the Probable Maximum Storm (runoff generated from 25% of the Probable Maximum Precipitation "PMP").



- Performed site reconnaissance, topographic surveys, and geotechnical investigations of the dam/spillway portion.
- Determined PMP rainfall distribution for 1, 2, 3, 6, 12, 24, 48 and 72 hour storms based on Hydro-Meteorological Report 52 (HMR52).
- Performed HEC-RAS modeling of the existing and proposed principal spillways to develop a discharge elevation-storage relationship.
- Performed hydrologic routing using HEC-HMS to identify the critical storm for the design of outlet structures, spillway and dam safety evaluation per TCEQ requirements.

- Performed 100-year storm rainfall and runoff computations and flood routing to identify potential hazardous situations and assisted in setting finished floor elevations and other amenities. Also performed HEC-HMS routing for multiple storms including the 100-year to further use in the preparation of a Letter of Map Revision (LOMR).
- Verified that "reinforced earth technology" can be economically and aesthetically utilized to stabilize the downstream face of the dam and principal spillway.
- Provided Design/Construction Documents of recommended improvements.

Lift Stations Design

- Determined hydraulic loading on the three (3) proposed lift stations based on land use plans and computed Average and Peak discharges.
- Evaluated topography and Force Main horizontal and vertical alignment to size force main and pumps, and identified additional design constraints.
- Obtained pump and lift station characteristics of existing system where multiple lift stations share common force mains.
- Performed hydraulic design combined with real time simulation of the two proposed simple standalone units and the complex integrated unit to project performance of the system and assist in identifying critical settings.
- Prepared site plans for proposed facilities showing proposed grading, layout of components, access and fencing.
- Coordinated with project team, City, and Review Engineer as required to finalize design.