REGIONAL WATERSHED STUDY

Large-Scale Regional Watershed Study on a Short Schedule

Jefferson County Drainage District No. 6

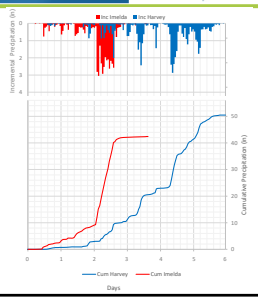
March 9, 2023

FREESE NICHOLS

Project Background

REGIONAL WATERSHED STUDY

- Extreme rainfall and flooding in Jefferson County
  - Hurricane Harvey 2017 – 60 in
  - T.S. Imelda 2019 – 40 in
  - May 2021 Storm
- Jefferson County DD6 is leading an effort to evaluate flood risks and find ways to reduce risks.



Project Background

REGIONAL WATERSHED STUDY

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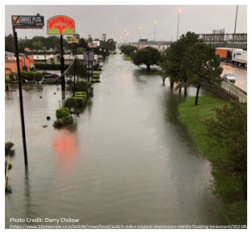
Project Goals

REGIONAL WATERSHED STUDY

- Identify areas of high flood risk and the sources of flooding.
- Develop large-scale regional flood reduction solutions to address flood damages.
- Prepare an implementation path for future projects that includes costs, benefits, challenges, and prioritization.



Project Team

REGIONAL WATERSHED STUDY

In partnership with:

Texas Water Development Board

Doug S. Canant, Jr., PE, RPLS, CFM
Jefferson County DD6
Interim Chief Operating Officer

Prime Consultant

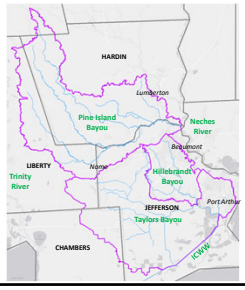
Sub-Consultant

Sub-Consultant

Study Area

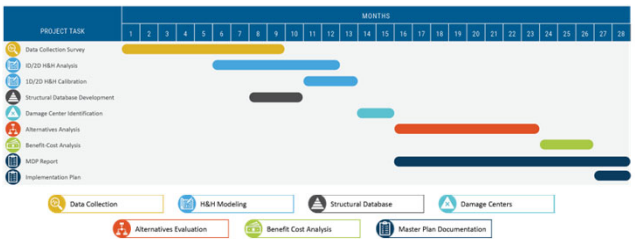
REGIONAL WATERSHED STUDY

- Drainage Area: 1,500 sq.mi.
- Stream Miles: 1,200 miles
- Topography:
  - Highest: 200 feet
  - Lowest: -25 feet
- Atlas 14 100-yr (24hr): 18.5 inches



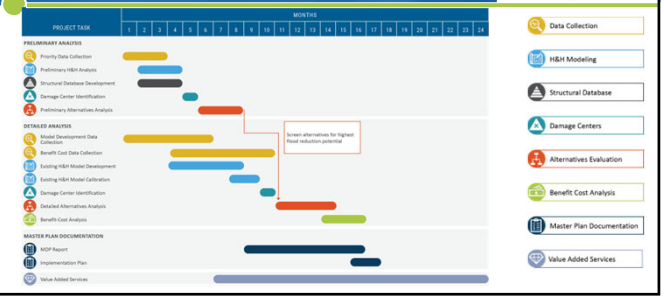
Challenges
Schedule: Traditional Approach

REGIONAL WATERSHED STUDY



Challenges
Schedule: Expedited Approach

REGIONAL WATERSHED STUDY

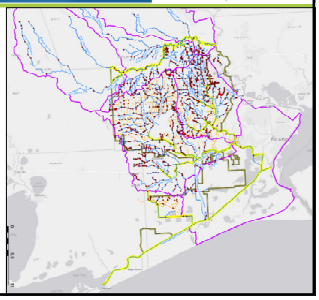


Data Collection

Survey
Prelim.
Detailed

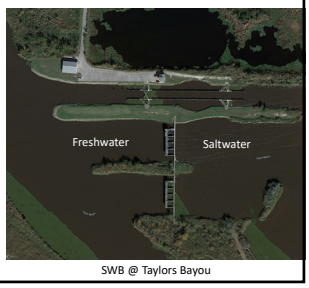
REGIONAL WATERSHED STUDY

- Key Structures
- Bathymetry
- Drainage Crossings
- Siphons



Data Collection
Key Structures

REGIONAL WATERSHED STUDY

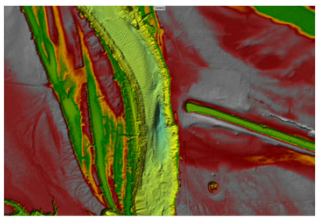


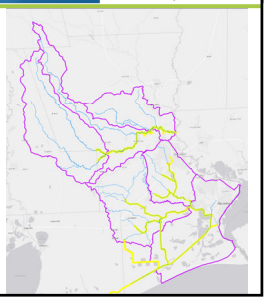
SWB @ Taylors Bayou

Data Collection
Bathymetry

REGIONAL WATERSHED STUDY

- Collected Bathymetry (~ 200 mi.)

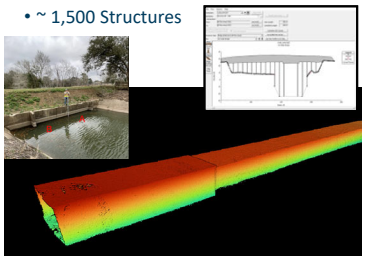


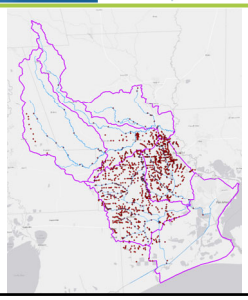


Data Collection
Drainage Crossings

REGIONAL WATERSHED STUDY

- ~ 1,500 Structures



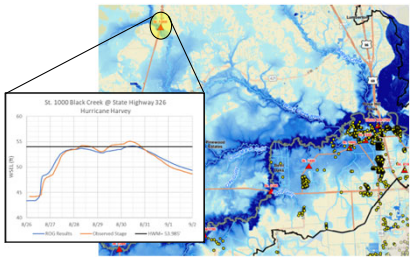


Preliminary Analysis
Existing Conditions

Survey
Prelim.
Detailed

REGIONAL WATERSHED STUDY

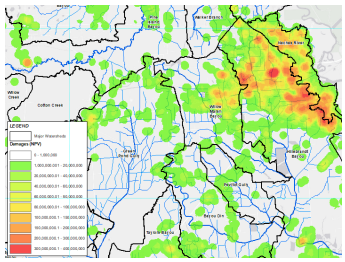
- Available LiDAR
- Rain-on-mesh
- Validation
  - Flood claims
  - Gage data
- Identify flooding sources



Preliminary Analysis
Focus Areas

REGIONAL WATERSHED STUDY

- Model Results
- Structure Database
- Based on flood risk (hardest hit areas)



Preliminary Analysis
Alternatives Analysis

REGIONAL WATERSHED STUDY

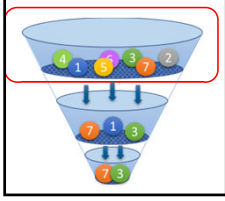
Existing

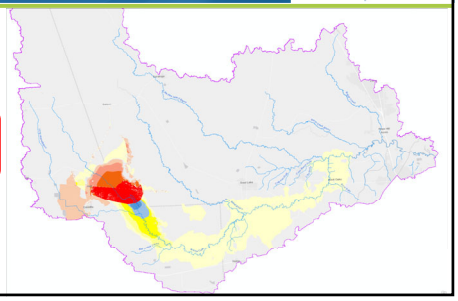
Proposed

Preliminary Analysis
Objective

REGIONAL WATERSHED STUDY

Preliminary Evaluation of Concepts

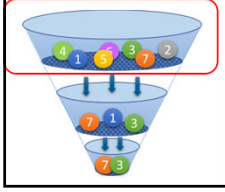


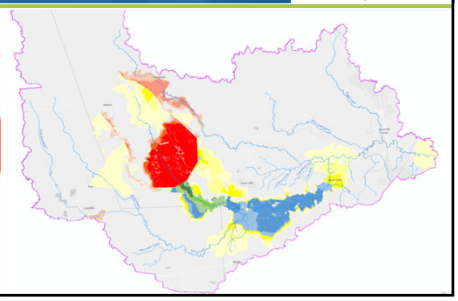


Preliminary Analysis
Objective

REGIONAL WATERSHED STUDY

Preliminary Evaluation of Concepts

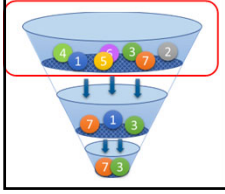


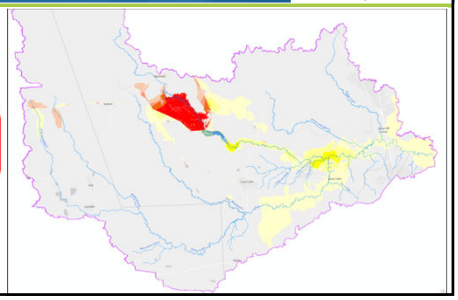


Preliminary Analysis
Objective

REGIONAL WATERSHED STUDY

Preliminary Evaluation of Concepts

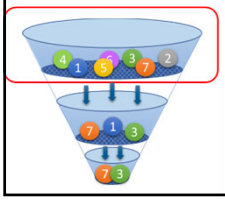


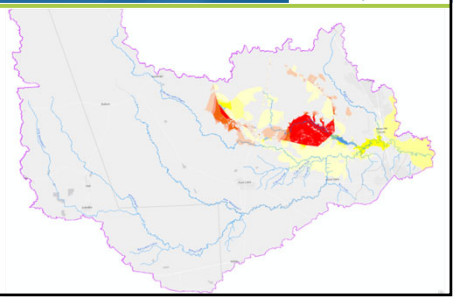


Preliminary Analysis
Objective

REGIONAL WATERSHED STUDY

Preliminary Evaluation of Concepts





Preliminary Analysis
Objective

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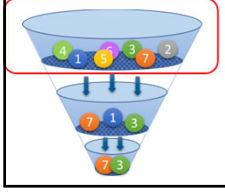
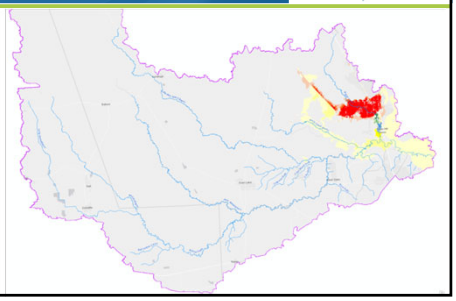


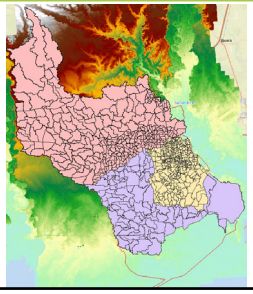


Detailed Analysis
Hydrologic Models

Survey
Prelim.
Detailed

REGIONAL WATERSHED STUDY

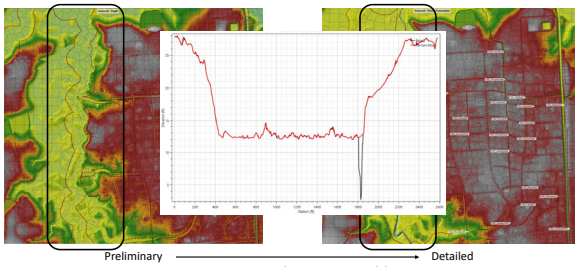
- HEC-HMS
- Used to generate flows
- Subbasin Delineations
- Generate parameters based on topography



Detailed Analysis
Hydraulic Models

Survey
Prelim.
Detailed

REGIONAL WATERSHED STUDY



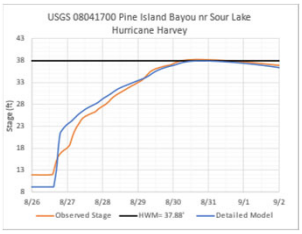
Preliminary → Detailed

Leverage Preliminary ROG Models

Detailed Analysis
Calibration

REGIONAL WATERSHED STUDY

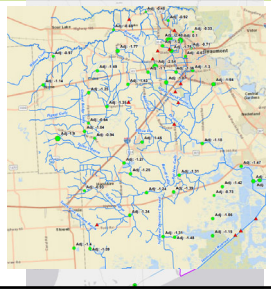
- Calibrate H&H Model to 3 Historical Events:
  - Harvey 2017: 60 inches
  - Imelda 2019: 40 inches
  - May 2021: ~ 10-yr
- Gage elevation adjustments
- Recent Improvements



Detailed Analysis
Gage Elevation Adjustments

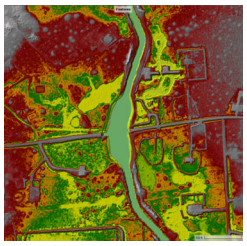
REGIONAL WATERSHED STUDY

- Vast network of gages
  - DD6
  - USGS
- Stages defined based on old benchmarks
- DD6 surveyed gages based on current benchmark
- Elevation Adjustments:
  - Range -2.76 ft to 1.9 ft



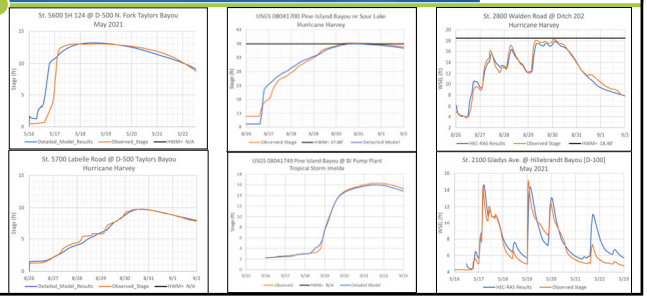
Detailed Analysis
Recent Improvements

REGIONAL WATERSHED STUDY



Detailed Analysis
Calibration

REGIONAL WATERSHED STUDY

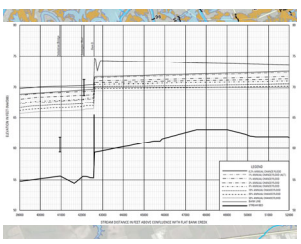


Detailed Analysis
Existing Conditions

Survey
Prelim.
Detailed

REGIONAL WATERSHED STUDY

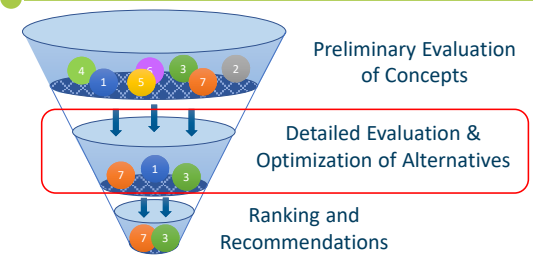
- Wide range of storms
- 2-yr to 500-yr events
- Documenting Findings
  - Report
  - GIS data
  - Inundation maps



Alternatives Funnel

REGIONAL WATERSHED STUDY

Survey
Prelim.
Detailed



Preliminary Evaluation of Concepts

Detailed Evaluation & Optimization of Alternatives

Ranking and Recommendations

Detailed Alternatives

REGIONAL WATERSHED STUDY

- Evaluate the best preliminary alternatives in detail

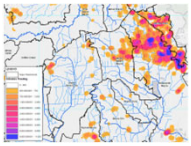
Benefit
Cost
Environmental
Constructability
Benefit Cost Analysis


Conveyance


Pump Stations

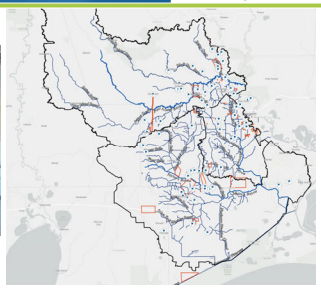

Environmental Constraints


Flood Retarding Structures


Maximize Benefits

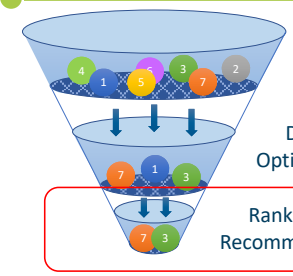
Public Feedback

REGIONAL WATERSHED STUDY



Alternatives Funnel

REGIONAL WATERSHED STUDY



Preliminary Evaluation of Concepts

Detailed Evaluation & Optimization of Alternatives

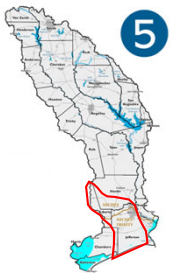
Ranking and Recommendations

- Benefit
- Cost
- Environmental
- Constructability
- Benefit Cost Analysis

End Game

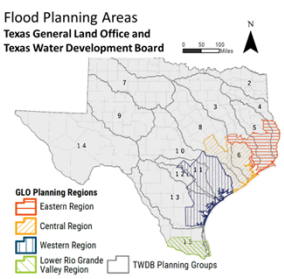
REGIONAL WATERSHED STUDY

- Develop an ***Implementable*** flood mitigation plan
- Identify potential ***funding*** sources
- Incorporate into Regional Flood Plan



Collaboration and Communication
Coordination with other studies

REGIONAL WATERSHED STUDY



Status

Survey
Prelim.
Detailed

REGIONAL WATERSHED STUDY

- ✓ Data Collection
- ✓ Preliminary Existing Conditions
- ✓ Preliminary Alternatives
- ➢ Detailed H&H Models (90%)
- • Detailed Alternatives
- • Implementation Plan

QUESTIONS

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INNOVATIVE APPROACHES…PRACTICAL RESULTS…OUTSTANDING SERVICE