

Flood Management Evaluation Memorandum

TO: Lauren Graber
Lower Colorado River Authority
P.O. Box 220
Austin, TX 78767

DATE: May 5, 2023

FROM: Jay Scanlon, PE, CFM
Freese and Nichols, Inc.
F-2144
10431 Morado Circle, Suite 200
Austin, TX 78759

PROJECT: LCRA Contract No. 5809
Halff AVO 43796.001
FNI HAF21363

SUBJECT: **FME ID:** 101000043
Project Sponsor: City of Fredericksburg
Project Name: Edison Street at Barons Creek



On September 15, 2022, the Lower Colorado-Lavaca Regional Flood Planning Group (RFPG) approved the evaluation of this Flood Management Evaluation (FME) to identify, evaluate and recommend additional potentially feasible Flood Mitigation Projects (FMP).

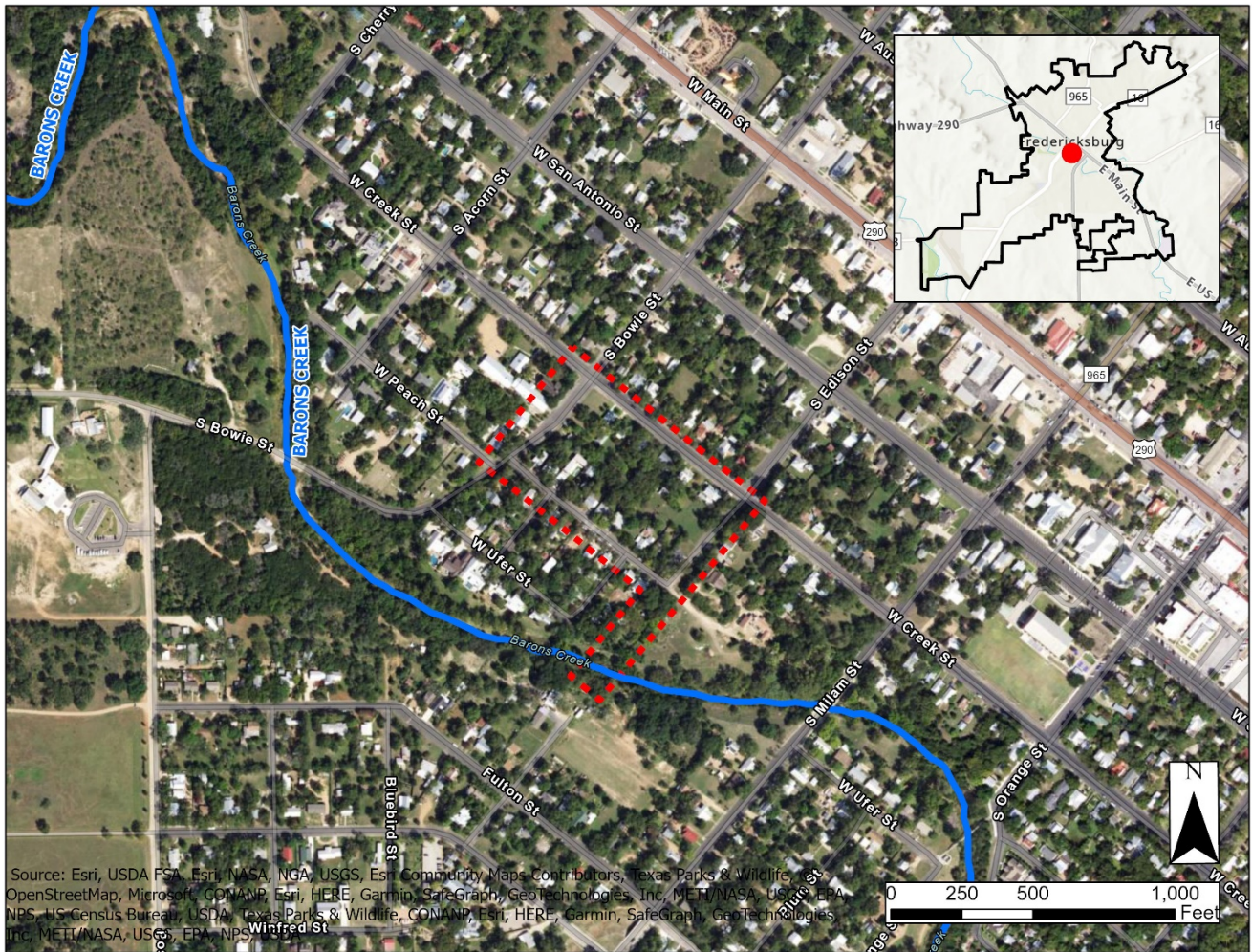
Introduction

The City's 2016 Drainage Master Plan (DMP) proposed local drainage improvements to Edison Street at Barons Creek. This action is included in the adopted Regional Flood Plan as a recommended FMP that anticipated local drainage improvements to include increasing the capacity of an existing channel and upsizing two culverts to provide safe access to adjacent houses. The project was identified and prioritized based on staff knowledge rather than detailed modeling. Based on the Sponsor request, the Regional Flood Planning Group (RFPG) recommended inclusion in the Regional Flood Plan (RFP) as FME 101000043.

Mr. Garret Bonn, Assistant City Engineer, and Interim Director of Development Services, was contacted to confirm the City's support to have the RFPG perform this FME, as described herein, as part of the Task 12 effort. Mr. Bonn confirmed the general nature of the flood problem, is supportive of the study, and assisted with local information and will review the report deliverables.

This FME includes updating the FEMA flood hazard analysis and mapping with ATLAS 14 rainfall data and evaluation of mitigation alternatives. If an alternative is determined to be feasible and provides flood risk reduction benefits the FME will include preliminary capital cost estimates, quantification of flood risk reduction benefits, benefit-cost analyses, adverse impacts evaluation, and a high-level evaluation of potential constraints including environmental permitting, utility relocations, right-of-way acquisition, and constructability issues in accordance with adopted FMP screening criteria.

Figure 1: Study Area Location



Modeling Analysis

The following sections provide an overview of the data, methodologies, hydrologic analysis, and hydraulic analysis used to identify the existing condition flood risk.

Data Collection

The sources of the key data collected and leveraged for analysis are listed below.

- Terrain Data: 2019 LiDAR (70cm), obtained from Texas Natural Resources Information System (TNRIS).
- Soils Data: 2022 Natural Resource Conservation Service (NRCS) Web Soil Survey.
- Land Use Data: 2019 National Land Cover Database (NLCD).
- Hydraulic model: HEC-RAS 1D model for Barons Creek was obtained from Federal Emergency Management Agency (FEMA) Base Level Engineering (BLE) Tools and Resources website.
- FEMA effective model: obtained from the 2016 DMP study.
- Spot elevations obtained from LiDAR and City Proposed design drawings.

Hydrology

In the original HEC-RAS 1D BLE model, a Regression Equation was applied to calculate the peak flows. There is no HEC-HMS model available for the entire BLE area. To update the hydraulic model with NOAA Atlas 14 rainfall, a HEC-RAS 2D Rain-on-Grid model was developed to generate peak flows for the HEC-RAS 1D BLE model.

- Modeling Software: HEC-RAS version 6.3.1
- Rainfall Data: NOAA Atlas 14, 24-hour duration (2-, 5-, 10-, 25-, 50-, 100-, and 500-year frequency storms).
- Loss Method: NRCS Curve Number loss rate method

Hydraulics

Because the study area is outside the main channel of Barons Creek, the HEC-RAS 2D rain-on-grid model with the Atlas 14 computed flows was utilized for hydraulic analysis. Structure data for the existing channel was developed using the LiDAR data and verified using plans developed for the proposed City design.

- Modeling Software: HEC-RAS version 6.3.1, 2D unsteady-state simulation.
- Hydrologic Data: see above.
- Boundary Conditions: Downstream normal depth

Existing Condition Flood Risk

The initial project was developed based on previous staff knowledge of street flooding and access issues in the vicinity of Edison Street at Peach Street. The streets within the study are considered residential and neighborhood collectors ranging in width from approximately 28- to over 50-ft wide. Curbs vary from non-existent to 12-inches. Based on model results, the maximum 100-year water depths in Edison Street and Bowie Street are approximately 1.31 and 1.71 feet, respectively. In addition, the maximum 100-year water surface elevation along the rear property lines between Edison and Bowie Streets is approximately 0.98 feet.

Table 1 presents maximum water surface depths for the 10-, 25- and 100-year events in Edison Street, Bowie Street, and at the rear property lines for the properties between the two streets. The existing inundation map is presented in **Figure 2**.

It is important to note that although the inundation map shows some structures within the study area are at-risk, the city does not have records of structural flooding. This is common for preliminary studies based on LiDAR data. The inundation limits reflect water surface elevations based on LiDAR generated contours and do not reflect constructed finished floor elevations. **Figure 3** is the street view of one of the potentially at-risk structures that shows the finished flood elevated above the nearest adjacent ground.

Table 1: Peak Water Surface Depths

	10-yr (ft)	25-yr (ft)	100-yr (ft)
Edison Street	1.50	1.65	1.83
Bowie Street	1.81	1.98	2.09
Rear Property Line	1.25	1.35	1.57

Figure 2: Existing Condition Flood Risk

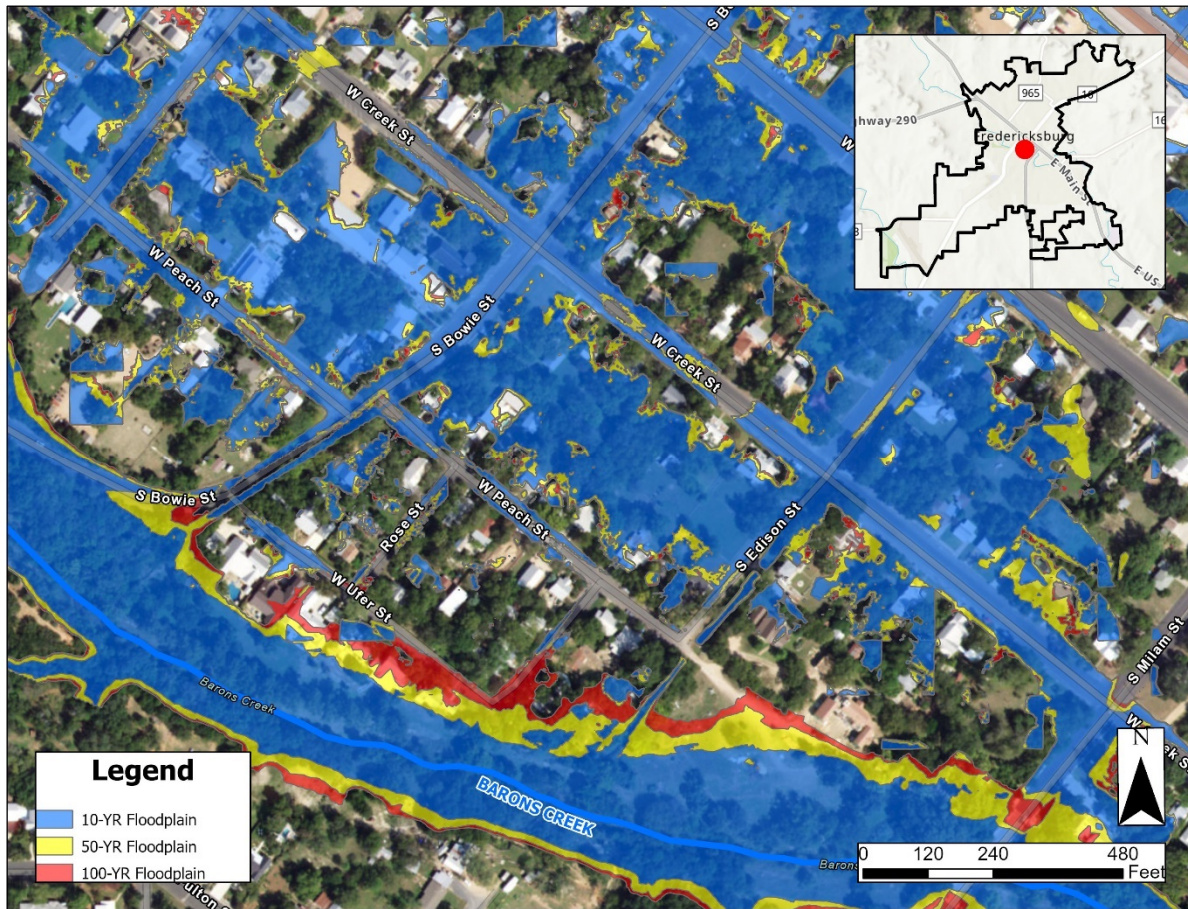
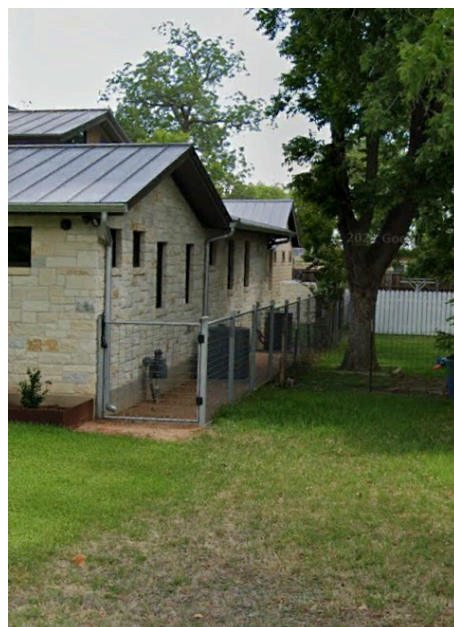


Figure 3: Example of Elevated Finished Floor



Proposed Improvements

Alternatives evaluated included the originally proposed design and two alternatives. The alternate design included:

- Original Proposed Design – Modifications to upsize the existing channel and culverts on the east side of Edison Street.
- Alternate 1 – Expand the original design to include a swale along the rear property lines (between Bowie and Edison Streets), install an area inlet and culvert to capture and convey flows to the improved channel on Edison Street.
- Alternate 2 – Expand the proposed storm drains (consisting of curb inlets and 8’ x 6’ RCB trunk lines) to capture and convey runoff directly to Barons Creek in Acorn Street, Bowie Street, and Edison Street.

A comparison of the maximum water surface depths is presented in **Table 2**.

Table 2: Peak Water Surface Depths

	10-yr (ft)			25-yr (ft)			100-yr (ft)		
	Original	Alt 1	Alt 2	Original	Alt 1	Alt 2	Original	Alt 1	Alt 2
Edison Street	1.37	1.37	1.05	1.42	1.42	1.14	1.77	1.77	1.31
Bowie Street	1.79	1.79	0.63	1.93	1.93	0.80	2.08	2.08	1.71
Rear Property Line	1.20	1.20	0.16	1.28	1.28	0.47	1.50	1.50	0.98

The proposed inundation maps are shown in **Figures 4 and 5**. Because there is no measurable difference between the original design and Alternate 1, both are represented in Figure 4.

Figure 4: Original Design and Alternative 1 Inundation Mapping

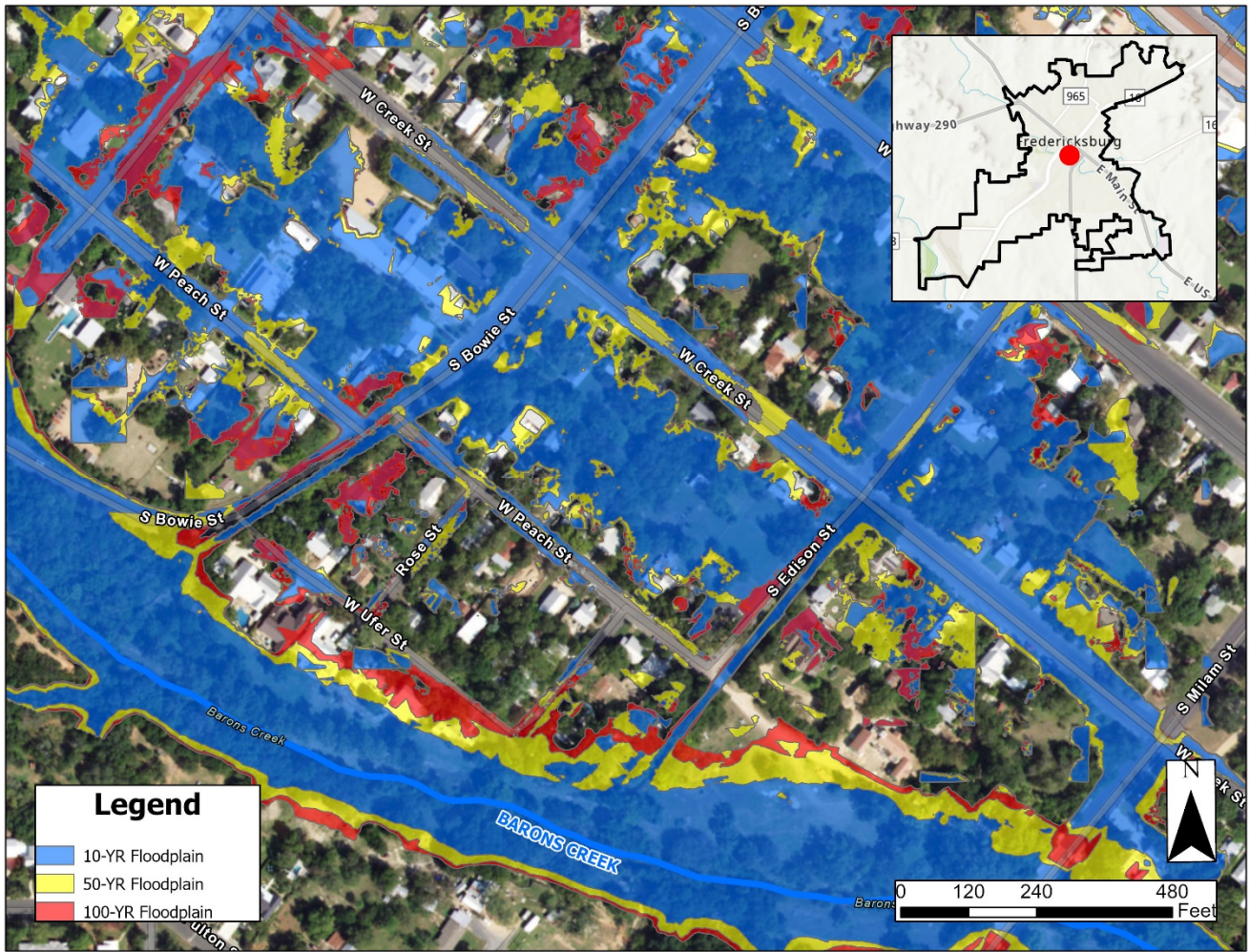
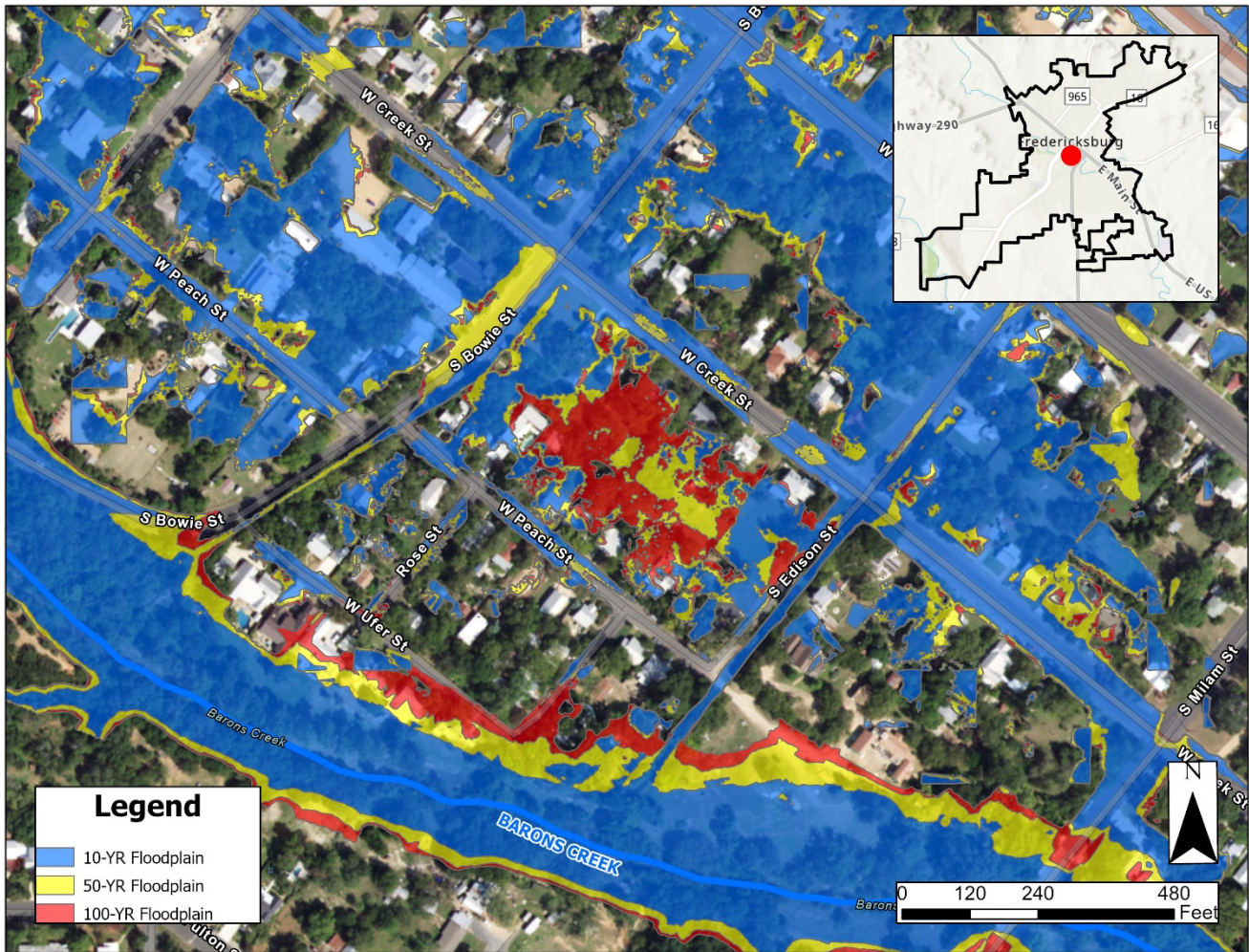


Figure 5: Alternative 2 Inundation Mapping

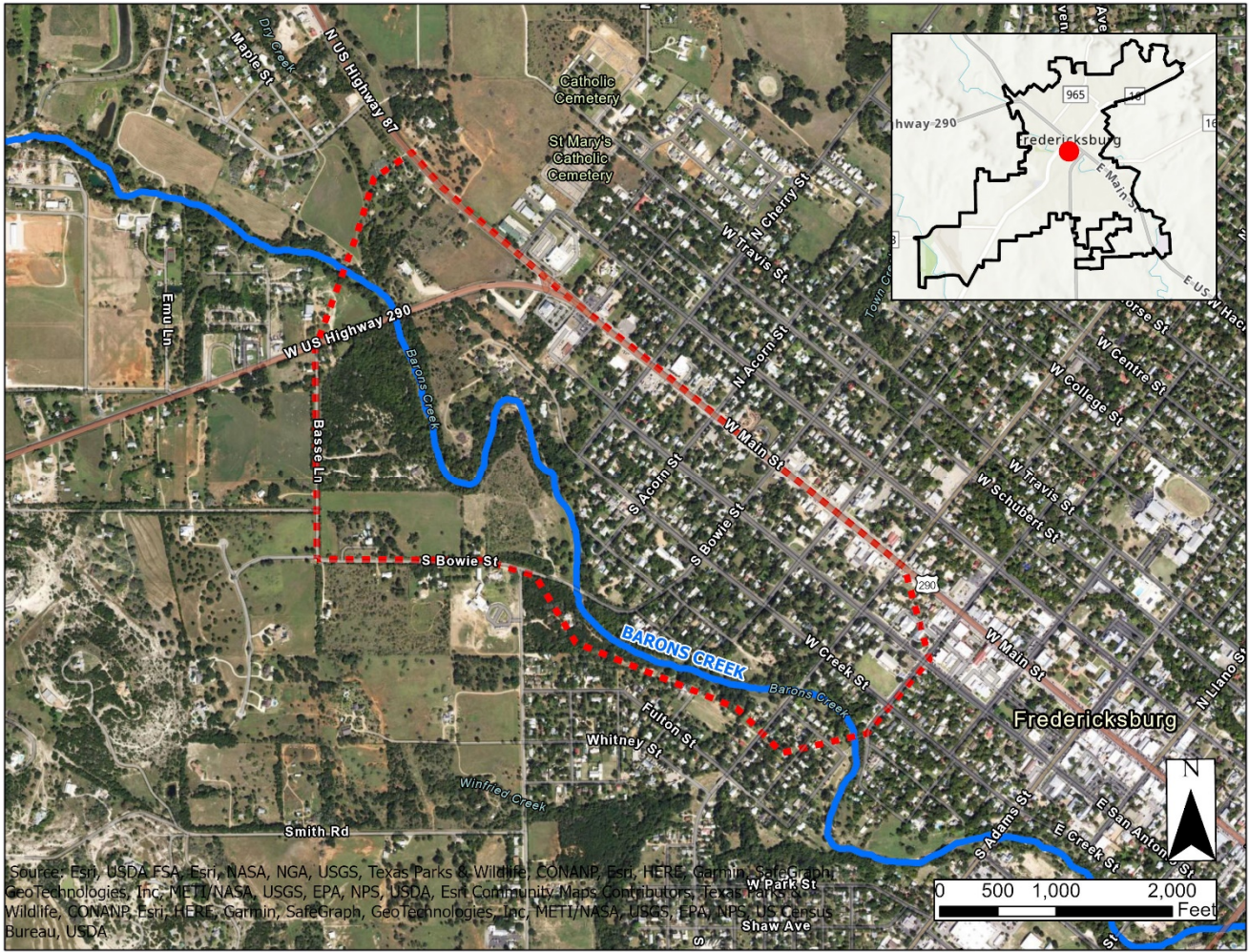


Freese and Nichols discussed the results of the alternatives evaluation with Mr. Garret Bonn. Mr. Bonn indicated that based on the limited flood risk reduction and potential cost of the system, the project is not feasible and he would not support advancing the study to an FMP. However, he did indicate the city has concerns with outfalls from the TxDOT system along Main Street (Highway 89/290) as well as other upstream road crossings on Barons Creek. After further discussion, Mr. Bonn stated his preference to modify the existing Flood Management Evaluation (FME) to study the area southwest of Main Street from upstream of State Highway 16 to upstream of U.S. 290.

Proposed Improvements

Based on the limited flood reduction benefits versus cost of this FME, and with concurrence from the Sponsor, we recommend FME10100043 be modified to reflect a more comprehensive evaluation of the area reflected in **Figure 6**.

Figure 6: Revised Future Study Area



- End of Memorandum -

Flood Management Evaluation (FME) STUDY

Lower Colorado-Lavaca
**REGIONAL FLOOD
PLANNING GROUP**

Title ID#
Sponsor (note if City or County) Commitment Yes No

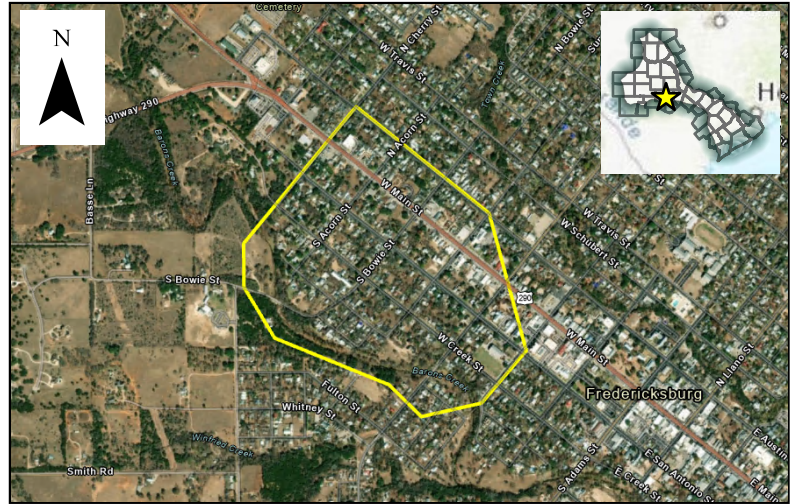
REGION 10

Study Type

Emergency preparedness Floodplain modeling, mapping and risk assessment Feasibility study Preliminary project engineering
Other

Problem Area

City County
Watershed name(s)
Tributary(ies)
HUC#(s) Stream miles (est.)
Drainage area: square miles, est or acreage, est
Social Vulnerability Index (SVI)
(SVI score 0.0 indicates least vulnerable; 1.0 indicates most vulnerable.)
Other



Flood Risk Description

Population at risk Structures at risk Critical facilities at risk (number)
Farm/Ranch land impacted (acres) Roadway(s) impacted (miles)

Scope of Study

Related Goal(s)

Estimated Study Cost

Cost Potential funding source(s)

Technical Memorandum Attachments

Attachment 1. Flood Mitigation Project

- FMP Summary Sheet