Lower Colorado-Lavaca
REGIONAL FLOOD
PLANNING GROUP
REGION 10

Flood Management Evaluation Memorandum

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

DATE: April 12, 2023

FROM: Paul Morales, PE, CFM, CPESC
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PROJECT: LCRA Contract No. 5809
Halff AVO 43796.001

DRAFT
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HALFF ASSOCIATES, INC.
TEXAS REGISTERED ENGINEERING FIRM F-312

SUBJECT: **FME ID: 101000102**
Project Sponsor: City of Bastrop
Project Name: Piney Creek Benching

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 of Bastrop identified Piney Creek channel benching improvements as a potential flood mitigation solution to reduce the 1% ACE using USGS rainfall data. These improvements would reduce the potential overtopping of State Highway (SH) 95 and would reduce the overtopping depth at Main Street and Reids Bend. The roads that cross Piney Creek floodplain are at grade and not elevated. The City is currently working on a Drainage Master Plan and is interested in making road crossing improvements for safety ingress/egress during significant storm events from the downtown core area of the City. Additional work is needed to meet TWDB requirements as a FMP which includes updating hydrologic and hydraulic analysis to use NOAA Atlas 14 rainfall data, a no adverse impact evaluation, updated cost estimates, a benefit cost analysis (BCA), and identification of potential constraints (e.g., environmental impacts, permitting, land acquisition, utility conflicts, and constructability). This memorandum provides an updated analysis for the Piney Creek Benching improvements and includes all required items to advance the project to an FMP.

Project Location and History

Piney Creek is a tributary to the Colorado River and located on the western edge of the city limits north of State Highway (SH) 71. **Figure 1** shows the extents of the Piney Creek benching project that extends approximately two (2) miles from the Union Pacific Railroad (UPRR) at the downstream end to SH 95 at the upstream limit. The project improvements include approximately 4,150 LF of channel benching, 2,200 LF of channel clearing or vegetation thinning, and bridge improvements at UPRR bridge, Main Street and pedestrian bridge, and SH95. UPRR bridge is proposed to be widened from a 150 foot span to a 300 foot span. Main Street bridge is currently a 100 foot span and is being proposed to a 300 foot span. The pedestrian bridge at Main Street is a 50 foot span and is proposed to be a 300 foot span to match Main Street. And finally, SH95 is currently a 60 foot span and is proposed to be a 250 foot span.

Improvements along Piney Creek were initially identified as part of the *Bastrop County Flood Protection Planning (FPP),* completed in 2018, which focused on flood mitigation within the City of Bastrop. The models developed as part of the FPP where then utilized and updated with new LiDAR terrain and NOAA Atlas 14 rainfall as part of the *Lower Colorado Cummings Phase 2 FEMA Preliminary Models and Mapping*, completed April 2020. The Lower Colorado Cummings models are being utilized in the *Bastrop County Flood Infrastructure Fund (FIF)* of the upper watershed of Piney Creek (in the County's jurisdiction) and is considered to be the best available data. The City of Bastrop is currently developing a city-wide Drainage Master Plan and has identified Piney Creek road crossing as flood problem areas and is utilizing the models developed as part of the FIF Piney Creek watershed study to develop flood mitigation solutions.

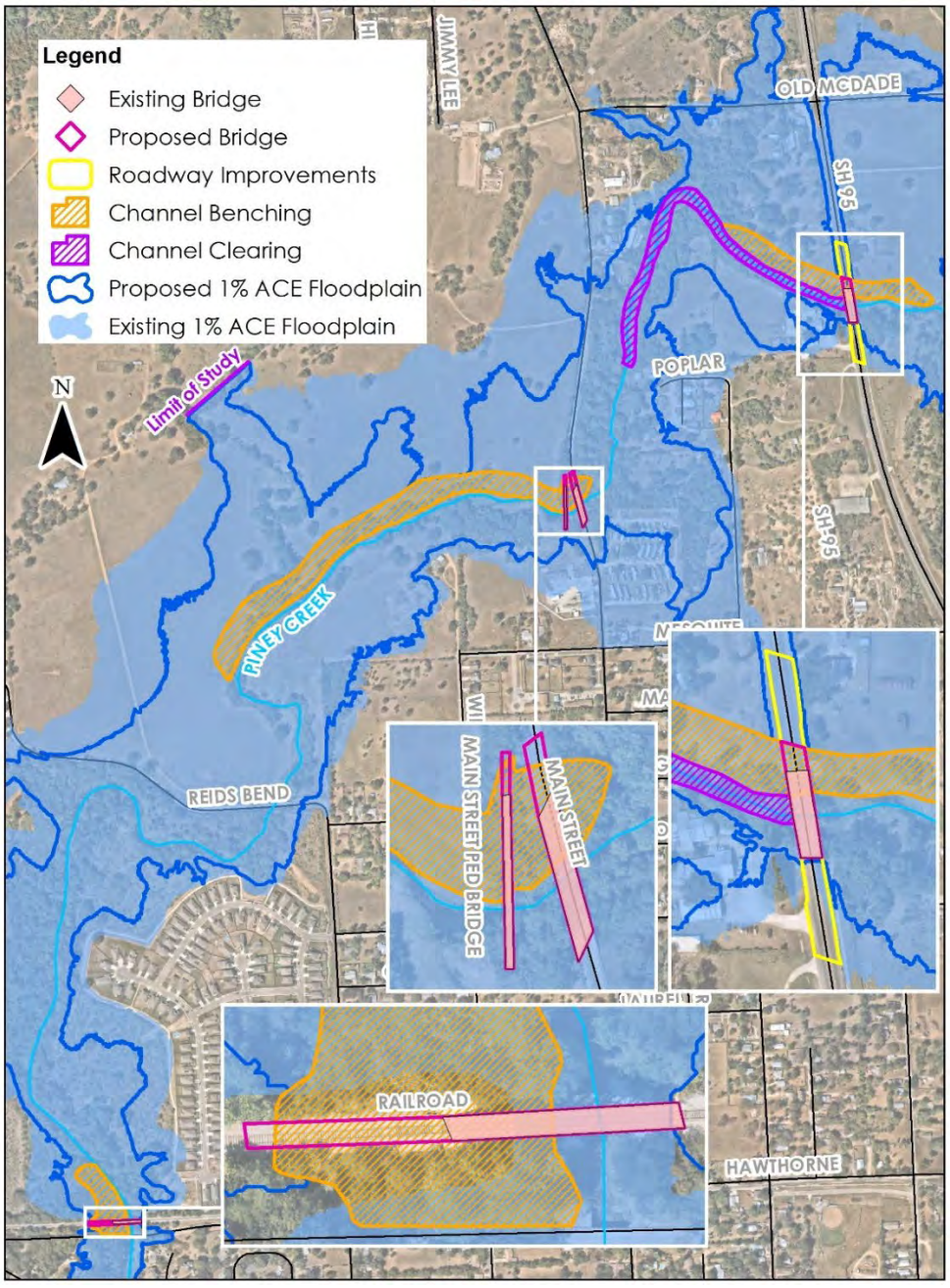


Figure 1: Study Area Location

Modeling Analysis

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

Data Collection and Site Visits

Halff obtained and reviewed, or performed the following items:

- Bastrop County Flood Protection Planning (FPP) Study for the Piney Creek watershed models dated March 2018
- TWDB CTP Flood Risk Project Mapping Activity Statement No. 14 for the Lower Colorado-Cummins Watershed Study dated April 2020
- Bastrop County Flood Infrastructure Fund (FIF) Study for the Piney Creek watershed currently ongoing
- Structure survey completed as part of the Bastrop County FPP and FIF watershed study
- Subsurface Utility Engineering (SUE) desktop analysis conducted in February 2023
- Environmental constraints desktop evaluation conducted in March 2023

The Bastrop County FIF watershed study was the foundation of this preliminary analysis. It used the following items for its analysis:

- Terrain Data: StratMap 2017 Central Texas LiDAR
- Soils Data: 2019 Natural Resource Conservation Service (NRCS) Web Soil Survey
- Land Use Data: 2011 National Land Cover Database
- Rainfall: NOAA Atlas 14

Hydrology

Below outlines the methodologies used for the hydrologic analysis:

- Modeling Software: HEC-HMS version 4.2
- Rainfall Data: NOAA Atlas 14, 24-hour duration, frequency storm temporal distribution
- Initial Losses: Initial and Constant loss method
- Hydrograph Approach: Snyder's Unit Hydrograph method
- Routing: Modified Puls
- Areal Reduction: Depth-area computations using TP-40

No changes to the Bastrop County FIF Piney Creek hydrologic models were made. **Table 1** below provides a summary of the peak flows along Piney Creek from the downstream study limit at UPERR to SH 95.

Table 1: Piney Creek Peak Flows

Location	Peak Flows (cfs)	
	50-year	100-year
State Highway 95	31,070	37,170
Main Street	31,230	37,430
Reids Bend	31,910	38,180
UPRR	31,970	38,250

Hydraulics

Below outlines the methodologies used for the hydraulic analysis:

- Modeling Software: HEC-RAS version 5.0.7, 1D steady-state simulation
- Hydrologic Data: see above
- Boundary Conditions: Downstream normal depth

Existing Condition Flood Risk

FEMA Floodplain

Piney Creek is a FEMA regulated stream with Zone AE designated floodplain as shown on Flood Insurance Rate Map (FIRM) Map Numbers 48021C0215E and 48021C0355E, dated January 19, 2006. FEMA is currently in the process of updating the Flood Insurance Study (FIS) for Bastrop County, Texas and Incorporated Areas. The preliminary FIS study, Number 48021CV000C, will become effective May 9, 2023. The preliminary FEMA FIS for Piney Creek is based on the *Lower Colorado Cummings FEMA Preliminary Modeling and Mapping*.

Existing Conditions

The existing conditions flood risk includes three road crossings that overtop and two subdivisions that flood during the 100-year storm event. **Figure 1 (above)** shows the Piney Creek the preliminary FEMA 100-year floodplain (effective May 9, 2023). The two subdivisions located in close proximity to the channel banks of Piney Creek are Bastrop Estates Mobile Home Park and Mercedes Cove subdivision, both of which are located in the FEMA regulated 100-year floodplain. **Table 2** below summarizes the roadway flood risk.

Table 2: Piney Creek Roadway Existing Flood Risk

Roadway	Existing Overtopping Depth (ft)		Approx. Level of Service
	50-year	100-year	
State Highway 95	0.6	2.3	25-year
Main Street	9.6	11.8	2-year
Reids Bend	13.7	16.7	10-year
UPRR	-	-	500-year

Proposed Improvements

The proposed improvements provide an all-weather access at SH95 and reduces overtopping at Main Street and Reids Bend during the 100-year storm event. Below is a summary of the proposed conveyance improvements shown on **Figure 1 (above)** that incorporates bridge improvements, channel benching improvements, and vegetation thinning to remove underbrush and sBrmaller trees within the channel. **Table 3** provides a summary of the proposed improvements. No improvements are proposed for Reids Bend due to the UPRR bridge creating significant backwater. Opening up the UPRR bottleneck is proposed to reduce the overtopping at Reids Bend and Main Steet.

Table 3: Summary of Proposed Improvements

Improvements	Existing Bridge Span (ft)	Proposed Bridge Span (ft)	Channel Benching (LF)	Vegetation Thinning (LF)
SH95 Bridge Improvement	190	250	1,200	2,200
Main Street Bridge Improvement	200	300	2,500	-
UPRR Bridge Improvement	150	300	450	-

Proposed channel benching was located approximately four feet above the Piney Creek flow line to minimize potential impacts to Waters of the US jurisdiction. Typical bench cut extends 80 feet with a 4(H):1(V) slope until the cut daylights. Channel vegetation thinning was considered to lower the roughness coefficient to promote efficient channel flow. Vegetation thinning would involve removal of underbrush vegetation while leaving trees of a selected size and native grasses to hold the soils in place to prevent erosion. See **Attachment 2** for the Piney Creek Benching FMP summary sheet for further project information.

Project Benefits

The Piney Creek Benching project includes three roadways to provide Bastrop residents ingress/egress to the city. During the 100-year storm event, SH95, Main Street, and Reids Bend overtop preventing safe access for residents and emergency needs. Providing a higher level of service for the roadway will allow residents and emergency vehicles a safe travel route during large storm events. **Table 4** summarizes the post-project overtopping depths that will be reduced and the proposed level of service at each bridge crossing. Level of service at SH 95 is increased from a 25-year storm event to a 100-year storm event creating and all-weather road creek crossing. Main Street show a reduced overtopping depth with an increase in level of service to a 10-year storm event from a 2-year storm event. Reids Bend level of service remains the same at a 10-year level of service. **Table 5** provides a summary of the risk reduction benefits.

Table 4: Piney Creek Roadway Proposed Reduced Flood Risk

Roadway	Proposed Overtopping Depth (ft)		Approx. Level of Service
	50-year	100-year	
State Highway 95	-	-	100-year
Main Street	6.3	8.1	10-year
Reids Bend	9.8	12.1	10-year
UPRR	-	-	500-year

Table 5: Risk Reduction Benefits

Flood Risk Condition	Number of At-Risk Buildings	Number of At-Risk Critical Facilities	Number of At-Risk Roadway Crossings (low water crossings)	Estimated At-Risk Daytime Population (based on building populations)	Impacted Agricultural Land (square miles of at-risk land cover)
Existing Condition 1% Annual Chance (100-year)	66	1	3	20	0.54
Post-Project Condition 1% Annual Chance (100-year)	28	0	2	7	0.4

Note: Number of at-risk roadway crossing counts are based on the overtopping roadways for this project and not based on the Regional Flood Plan low water crossing database.

Estimate of Probable Cost

An opinion of probable cost was prepared for the proposed Piney Creek Benching project. The cost estimate includes construction and soft costs (engineering, permitting, construction phase services, etc.). Local and regional TxDOT average bid unit costs provided a basis for estimating unit costs for construction items. A percentage of the construction costs was applied for each soft cost item. A 30% contingency was applied to the construction cost

subtotal to account for uncertainties and assumptions made in the conceptual design development. The total project cost is estimated at $23,991,550. A detailed project cost breakdown is located in the **Attachment 2**.

Project Constraints

Potential constraints identified for this project include environmental permitting constraints, utility relocation/conflicts, and multi-jurisdictional coordination.

Environmental Constraints

A desktop level environmental constraints analysis was performed for the proposed project. The analysis included water resources, biological resources, and cultural resources assessments. A report was prepared discussing the findings of the analysis and is included as **Attachment 3**. **Table 5** (next page) summarizes the environmental constraints.

Utility Conflicts

A Quality Level (QL) D (records request only) subsurface utility evaluation was conducted to identify potential utility conflicts in the project area. Utilities identified are City of Bastrop water and wastewater lines, Bastrop Power and Light, ATT&T aerial and buried lines, LCRA electrical transmission lines, ONCOR electric transmission lines, Bluebonnet natural gas pipeline, and Spectrum lines. Primarily, utilities were located within the public right of way at each of the roadway creek crossings. As the project advances, further evaluation and coordination of existing utilities is required to determine if protecting or relocating the utilities is required.

Table 5: Environmental Constraints Summary

Regulating Entity	Database Findings	Applicable Regulations
Waters of the US (WOTUS)/US Army Corps of Engineers (USACE)/Section 404 of the Clean Water Act (CWA)	National Wetlands Inventory (NWI) indicates mapped wetlands	Section 404 of the CWA
Federal Emergency Management Agency (FEMA)	Regulated Zone AE and A	FEMA/Local Jurisdiction FEMA Floodplain Regulations and local ordinances
Protected Species/US Fish and Wildlife Service (USFWS)	IPaC report identifies four bird species, two amphibian species, on insect species, three arachnid species, and one plant species are federally listed either threatened or endangered in Bastrop County.	Endangered Species Act (ESA)
Critical Habitat/US Fish and Wildlife Service (USFWS)	Critical habitat for the Houston toad in close proximity of project area.	Endangered Species Act (ESA)
Rare, Threatened, and Endangered Species of Texas (RTEST)/Texas Parks and Wildlife Department (TPWD)	65 species listed on TPWD's RTEST list for Bastrop County	TPWD Code and Texas Administrative Code (TAC) for protected state listed species

Drainage Easement

To allow access to maintain the proposed channel benching, a drainage easement is required. A drainage easement will allow City of Bastrop to perform needed maintenance to ensure the channel benching functions as designed. The easement should extend the entire limits of the proposed benching. During design, more detailed

extents of the easement will need to be determined and a meets and bounds legal description and sketch of the easement should be prepared.

Multi-Jurisdictional Coordination

Piney Creek is located at the western most city limits which is a shared jurisdictional boundary for City of Bastrop and Bastrop County. Both Main Street and Reids Bend will require City and County coordination for the proposed bridge and channel benching improvements. Proposed railroad improvements will need coordination and approval with UPRR to widen the timber railroad bridge. Finally, SH 95 is a TxDOT on-system roadway and will require coordination with TxDOT for the proposed improvements.

Benefit Cost Analysis

The TWDB Benefit Tool Kit was used to determine the Benefit Cost Analysis (BCA) for the Piney Creek Benching project. By creating an all-weather access road crossing at SH95, the detour mileage is significantly reduced by approximately 30% which directly reduces the emergency services response times. Traffic counts were taking from the TxDOT TPP Statewide Annual Average Daily Traffic (AADT) for SH95, Main Street, and Reids Bend. Agricultural damages were also considered based on the Regional Flood Plan database to determine agricultural losses. To determine damages, the 50- and 100-year storm events were used to estimate expected damages for both residential and commercial properties. An electrical substation is located in the floodplain extents but was not included due to unknown information requested by the TPWD Benefit Tool Kit. Similarly, green infrastructure elements were not included in the BCA analysis due to unknown information requested in the tool kit. As the project advances, this data can be obtained to refine the BCA. The known available data was entered into the TPWD Benefit Tool Kit to determine a preliminary benefit cost ratio of 0.1. See **Attachment 2** for the data inputs for the Benefit Cost Analysis (BCA).

No Negative Impact

In accordance with the *TWDB Technical Guidelines for Regional Flood Planning*, "No Negative Impact means that a project will not increase flood risk of surrounding properties. Using best available data, the increase in flood risk must be measured by the 100-year frequency storm event water surface elevation and peak discharge. It is recommended that no rise in water surface elevation or discharge should be permissible, and that the analysis extent must be vast enough to prove proposed project conditions are equal to or less than the existing conditions."

The preliminary modeling confirms the following:

- Stormwater does not increase inundation in areas beyond the public right-of-way, project property, or easement.
- Stormwater does not increase inundation of storm drainage networks, channels, and roadways beyond design capacity.
- Maximum increase of 1D Water Surface Elevation rounds to 0.0 feet (< 0.05ft) measured along the hydraulic cross-section within the right-of-way.

This memorandum is prepared to serve as certification of no negative impact for the Piney Creek Benching flood mitigation project. As the project is advanced, the impact analysis should be updated to reflect final design and confirm no negative impacts.

Technical Memorandum Attachments

Attachment 1. TWDB-Required Tables

- Table 16: Recommended Flood Mitigation Projects
- Geodatabase Table: Project Details

Attachment 2. Flood Mitigation Project

- FMP Summary Sheet
- Cost Estimate
- Benefit Cost Ratio

Attachment 3. Environmental Constraints Report

Attachment 1

TWDB-Required Tables

Attachment 2

Flood Mitigation Project

Flood Mitigation Project (FMP)

Lower Colorado-Lavaca
REGIONAL FLOOD PLANNING GROUP
REGION 10

Title: Piney Creek Benching | ID#: 101000102

Sponsor (note if City or County): City of Bastrop | Commitment: ✓ Yes ☐ No

Technical committee recommend: ☐ Yes ☐ No | RFPG recommend: ☐ Yes ☐ No

Project Type

STRUCTURAL

☐ Detention ✓ Channel modification ✓ Bridge/culvert ☐ Storm drain ☐ Levee/floodwall

Other:

NON-STRUCTURAL

☐ Property buyouts ☐ Floodproofing ☐ Flood readiness/resilience ☐ Flood warning system/gauges

Other:

Problem Area

City: Bastrop | County: Bastrop

Watershed name(s): Piney Creek

Tributary(ies): n/a

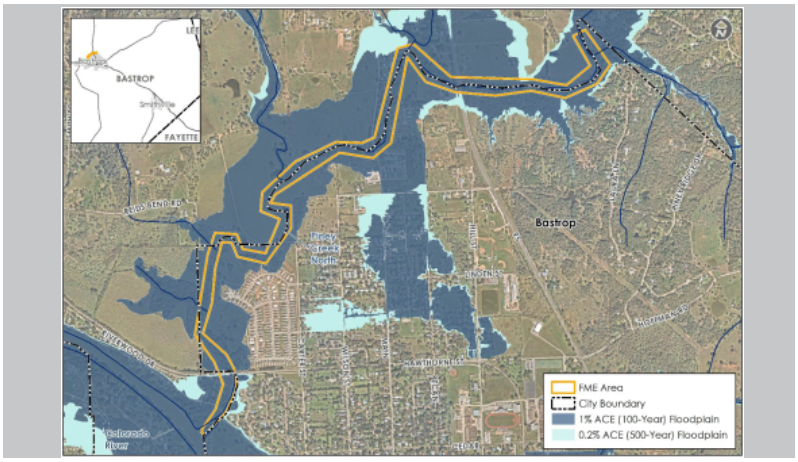
HUC#(s): | Stream miles (est.): 2

Drainage area: square miles, est: 49.6 sqmi | or acreage, est:

Social Vulnerability Index (SVI):

(SVI score 0.0 indicates least vulnerable; 1.0 indicates most vulnerable.)

Other:



Flood Risk Description

The existing conditions flood risk includes three road crossings that overtop and two subdivisions that flood during the 100-year storm event. Overtopping roads include SH95, Main Street, and Reids Bend. These roads are access routes for residents in and out of Bastrop. The two subdivisions are located in close proximity to the channel banks of Piney Creek are Bastrop Estates Mobile Home Park and Mercedes Cove subdivision, both of which are located in the FEMA regulated 100-year floodplain.

Proposed level-of-service: 100-year | Status: Preliminary engineering | Atlas 14 rainfall used: Yes

Project Description

The proposed improvements provide an all-weather access at SH95 and reduces overtoping at Main Street and Reids Bend during the 100-year storm event. The Project incorporates bridge improvements, channel benching improvements, and vegetation thinning to remove underbrush and smaller trees within the channel conveyance area.

Related Goal(s)

6.2 Increase the number of entities that mitigate flood risk at vulnerable roadways or waterways (e.g., low-water crossings, irrigation canals).

Estimated Project Cost

Capital cost: $23,991,550 | Ongoing O&M costs: TBD | Cost/benefit analysis: 0.1

Potential funding source(s): TBD

Project: Piney Creek Benching
Engineer's Estimate of Probable Construction Cost
Date: April 6, 2023

halff

PAY ITEM NO	DESCRIPTION	UNITS	UNIT PRICE	QTY	TOTALS
	UNION PACIFIC RAILROAD				
1	REMOVING CONC (RIPRAP)	SY	$81	700	$56,700
2	EXCAVATION (CHANNEL)	CY	$25	25,657	$641,425
3	PREPARING ROW	AC	$40,000	1	$53,200
4	RIPRAP (STONE PROTECTION)(D_{50}=18 IN)	CY	$223	550	$122,865
5	REMOV STR (BRIDGE 100 - 499 FT LENGTH)	EA	$50,000	1	$50,000
6	RAILROAD	SF	$150	5,000	$750,000
7	PERMANENT EROSION CONTROL	SY	$20	6,437	$128,740
				RAILROAD SUBTOTAL	**$1,802,929.50**
8	MOBILIZATION		10%		$180,293
9	TEMPORARY EROSION CONTROL		2%		$36,059
10	TRAFFIC CONTROL		2%		$36,059
				CROSSING SUBTOTAL	**$2,055,340**
				30% CONTINGENCY	**$616,602**
				BASE TOTAL	**$2,671,942**
11	ENVIRONMENTAL PERMITTING		2%		$53,439
12	ENGINEERING DESIGN & GEOTECH		15%		$400,791
13	CONSTRUCTION SERVICES & TESTING		10%		$267,194
				UNION PACIFIC RAILROAD	**$3,393,366**
	MAIN ST				
14	EXCAVATION (CHANNEL)	CY	$25	138,503	$3,462,575
15	PREPARING ROW	AC	$40,000	7.2	$288,000
16	RIPRAP (STONE PROTECTION)(D_{50}=18 IN)	CY	$223	1,330	$297,109
17	REMOV STR (BRIDGE 100 - 499 FT LENGTH)	EA	$50,000	2	$100,000
18	BRIDGE	SF	$150	8,688	$1,303,200
19	BRIDGE (PEDESTRIAN)	SF	$150	3,270	$490,500
20	RAIL	LF	$180	400	$72,000
21	PERMANENT EROSION CONTROL	SY	$20	34,850	$697,000
				MAIN ST SUBTOTAL	**$6,710,383.70**
22	MOBILIZATION		10%		$671,038
23	TEMPORARY EROSION CONTROL		2%		$134,208
24	UTILITY RELOCATION		5%		$335,519
25	TRAFFIC CONTROL		2%		$134,208
				CROSSING SUBTOTAL	**$7,985,357**
				30% CONTINGENCY	**$2,395,607**
				BASE TOTAL	**$10,380,964**
26	ENVIRONMENTAL PERMITTING		2%		$207,619
27	ENGINEERING DESIGN & GEOTECH		15%		$1,557,145
28	CONSTRUCTION SERVICES & TESTING		10%		$1,038,096
				MAIN ST	**$13,183,824**
	SH95				
29	EXCAVATION (ROADWAY)	CY	$25	25	$625
30	EXCAVATION (CHANNEL)	CY	$25	55,786	$1,394,650
31	PREPARING ROW	AC	$40,000	6	$240,000
32	REMOV STR (BRIDGE 100 - 499 FT LENGTH)	EA	$50,000	1	$50,000
33	BRIDGE	SF	$150	11,665	$1,749,750
34	EMBANKMENT (FINAL)(DENS CONT)(TY C)	CY	$45	25	$1,125
35	CUT & RESTORING PAVEMENT (BASE AND HMAC)	SY	$150	75	$11,250
36	RIPRAP (STONE PROTECTION)(D_{50}=18 IN)	CY	$223	1,300	$290,407
37	RAIL	LF	$180	200	$36,000
				SH95 SUBTOTAL	**$3,773,807.00**
38	MOBILIZATION		10%		$377,381
39	TEMPORARY EROSION CONTROL		2%		$75,476
40	UTILITY RELOCATION		5%		$188,690
41	TRAFFIC CONTROL		2%		$75,476
				CROSSING SUBTOTAL	**$4,490,830**
				30% CONTINGENCY	**$1,347,249**
				BASE TOTAL	**$5,838,079**
41	ENVIRONMENTAL PERMITTING		2%		$116,762
42	ENGINEERING DESIGN & GEOTECH		15%		$875,712
43	CONSTRUCTION SERVICES & TESTING		10%		$583,808
				SH95	**$7,414,361**
				PROJECT TOTAL	**$23,991,550**

This statement was prepared utilizing standard cost estimate practices. It is understood and agreed that this is an estimate only, and that Engineer shall not be held liable to Owner or third party for any failure to accurately estimate the cost of the project, or any part thereof. Unit prices are in current dollars and should be adjusted as required when letting schedule for project is determined.

This workbook has been designed to work in conjunction with FEMA's BCA Toolkit v6.0 to calculate the Benefit-Cost Ratio (BCR) of flood risk management projects for the Texas Water Development Board (TWDB).

The BCA Input Workbook is designed to help collate the necessary input data and to calculate the Baseline (Before Mitigation) and Project (After Mitigation) Damages. These damages are then input into the FEMA BCA Toolkit to calculate the Project benefits.

Instructions on how to download and install the FEMA BCA Toolkit v6.0 can be found here.
Please refer to Model Instructions for detailed instructions on how to use this workbook.
Input cells are highlighted green.

The TWDB BCA Input Workbook calculates benefits from the following benefit areas, which will be input into the BCA Toolkit:

- Structure damages & associated loss of function
- Reduction in street flooding
- Utility loss of function
- Agricultural damages
- Low water crossings replacements

The following benefit areas are calculated entirely in the BCA Toolkit:

- Critical facility loss of function

The following benefit areas are calculated entirely in the TWDB BCA Input Workbook:

- Recreation benefits
- Water supply benefits
- Environmental benefits of green infrastructure
- Residual value of investment

Project Name	Piney Creek Benching
Project Region	Region 10
Project Type	Channel Benching and Road Crossing Impro

Start Construction Year	2028
End Construction Year	2030

Input up to 3 Recurrence Intervals for which you have water level (H&H) data.
At least 1 Recurrence Interval must be the 100-year storm.
Recurrence Intervals must be input in decreasing order of likelihood (i.e., 50-year storm before 100-year storm).

Recurrence Interval 1	50	year storm
Recurrence Interval 2	100	year storm
Recurrence Interval 3		

Types of Project Impacts

Residential Structure Damage Reduction	Yes	Input structure data and water levels in 'Residential_Structures' sheet; Damage totals will be shown in 'Total Impacts'
Commercial Structure Damage Reduction	Yes	Input structure data and water levels in 'Commercial_Structures' sheet; Damage totals will be shown in 'Total Impacts'
Critical Facility (Police, Fire, Hospital) Loss of Function Reduction	No	
Reduction in Street Flooding	Yes	Input water levels and detour information in the 'Flooded Streets' sheet; Damage totals will be shown in 'Total Impacts'
Utility Outage Reduction	No	
Agricultural Damage Reduction	Yes	Input affected acreages in 'Other Inputs' sheet; Damage totals will be shown in 'Total Impacts'
Water Supply Benefits	No	
Recreation Benefits	No	

Does this project include Green Infrastructure elements?	No
Does this project replace a low-water crossing?	No

Capital Cost	
Right-of-Way	
Utility Relocation	$524,210
Construction	$23,467,341
Total Capital Cost	**$23,991,551**
Operations & Maintenance (O&M)	
Baseline Annual O&M	
Project Annual O&M	
Increased Annual O&M	**$0**
Project Lifespan (years)	50

	Structure Information			50 - year storm				100 - year storm			
	Location	Structure Type	Number of Structures	Baseline Flood Depth	Baseline Damages	Project Flood Depth	Project Damages	Baseline Flood Depth2	Baseline Damages2	Project Flood Depth2	Project Damages2
1	2106 Dragonfly Loop	Average Home	1	0		0		1"	$29,580	0	
2	320 Linden Street	Average Home	1	0		0		1"	$29,580	0	
3	326 Linden Street	Average Home	1	0		0		1"	$29,580	0	
4	Bastrop Estates Mobile Home Park 1	Average Home	1	0		0		1"	$29,580	0	
5	Bastrop Estates Mobile Home Park 2	Average Home	1	0		0		1"	$29,580	0	
6	Bastrop Estates Mobile Home Park 3	Small Home	1	0		0		1"	$11,938	0	
7	Bastrop Estates Mobile Home Park 4	Average Home	1	0		0		1"	$29,580	0	
8	Bastrop Estates Mobile Home Park 5	Small Home	1	0		0		1"	$11,938	0	
9	Bastrop Estates Mobile Home Park 6	Average Home	1	0		0		1"	$29,580	0	
10	Bastrop Estates Mobile Home Park 7	Average Home	1	0		0		1"	$29,580	0	
11	Bastrop Estates Mobile Home Park 8	Average Home	1	0		0		1"	$29,580	0	
12	Bastrop Estates Mobile Home Park 9	Average Home	1	0		0		2"	$29,674	0	
13	104 Mercedes Cove	Average Home	1	3"	$32,317	0		5"	$50,029	0	
14	107 Mercedes Cove	Average Home	1	0		0		1"	$29,580	0	
15	105 Mercedes Cove	Average Home	1	0		0		1"	$29,580	0	
16	103 Mercedes Cove	Average Home	1	0		0		1"	$29,580	0	
17	102 Mercedes Cove	Average Home	1	0		0		1"	$29,580	0	
18	101 Mercedes Cove	Average Home	1	0		0		1"	$29,580	0	
19	703 Poplar Street	Average Home	1	2"	$29,674	0		5"	$50,029	0	
20	2755 N Main Street	Average Home	1	3"	$32,317	0		5"	$50,029	1"	$29,580
21	2759 Old McDade Rd	Average Home	1	0		0		1"	$29,580	0	
22	548 State Hwy 95	Average Home	1	8"	$64,823	7"	$61,121	10"	$72,224	9"	$68,524
23	566 State Hwy 95	Small Home	1	0		0		2"	$12,015	0	
24	129 Old McDade Road	Average Home	1	2"	$29,674	0		4"	$42,540	2"	$29,674
25	804 Poplar Street	Average Home	1	0		0		2"	$29,674	0	
26	564 State Hwy 95	Small Home	1	0		0		1"	$11,938	0	
27	568 State Hwy 95	Average Home	1	1"	$29,580	0		2"	$29,674	1"	$29,580
			27		**$218,384**		**$61,121**		**$845,403**		**$157,358**
					6		1		27		4

						50 - year storm			
	Address or Business Name	Structure Type	Basis of Value	Structure Value	Square Footage	Baseline Flood Depth	Baseline Damages	Project Flood Depth	Project Damages
1	Bastrop Veternary Hospital	Medical Office	Square Footage		5,178	0		0	
2	570 State Hwy 95	Convenience Store	Square Footage		2277	2"	$8,659	0	
					7,455		$8,659		**$0**

	100 - year storm			
	Baseline Flood Depth2	Baseline Damages2	Project Flood Depth2	Project Damages2
1	2"	$17,677	0	
2	3"	$11,660	1"	$5,659
		$29,337		**$5,659**

	50 - year storm		100 - year storm	
	Baseline	**Project**	**Baseline2**	**Project2**
How many miles of roadway is flooded >6"?	0.7	0.47	1.05	0.59
How long are the roadways impassable (hours)?	15.55	11.77	19.45	14.25
What is the daily traffic (vehicle count) on the affected roadways?	21,458	21,458	21,458	21,458
How much mileage does the detour add to the route? (Difference between direct route and detour)	50.13	34.58	50.13	34.58
How much time (minutes) does the detour add to the route? (Difference between direct route and detour)	100.26	69.16	100.26	69.16
Normal Emergency Medical Services (EMS) response time (minutes)	30			
EMS response time during storm event	130.26	99	130.26	99
Number of households impacted by EMS delay due to flooded streets	3699	3699	3699	3699
Number of commercial buildings impacted by EMS delay due to flooded streets	292	292	292	292

****Note: These impacts will only be included in the Total Impacts if "Yes" is selected under "Types of Project Impacts" on the Project Information sheet.**

Does the project reduce utility outages?	**No**
Does the project increase water supply?	**No**
Does the project impact flooding on agricultural lands?	**Yes**

	50 - year storm		100 - year storm	
Acreage	**Baseline**	**Project**	**Baseline2**	**Project2**
Acres of pasture damaged	252.6	185.9	318.9	242.1
Acres of high-value crops damaged				
Acres of low-value crops damaged	18.7	12.4	24.1	16.8

Crop Type	**Damage/Acre**
Pasture	$200
High-Value Crops	
Low-Value Crops	$300

Does the project include any green infrastructure elements?	**No**

Project Impacts by Recurrence Interval	50 - year storm		100 - year storm	
	Baseline	Project	Baseline2	Project2
Residential Flood Damage	$445,606	$102,653	$1,850,127	$309,158
Commercial Flood Damage	$18,759	$0	$56,886	$12,428
Flooded Streets	$1,461,413	$760,877	$1,827,941	$921,198
Utility Impacts	-	-	-	-
Agricultural Losses	$56,130	$40,900	$71,010	$53,460
Low Water Crossing Damages	-	-	-	-

Flooded Structures by Recurrence Interval	50 - year storm		100 - year storm	
	Baseline	Project	Baseline2	Project2
Flooded residential structures	**6**	**1**	**27**	**4**
Impacted Residents	18	3	81	12
Flooded commercial structures	**1**	**0**	**2**	**1**
Impacted Employees	10	0	20	10

Other Project Impacts	Benefits
Water Supply Benefits	-
Environmental Benefits	-
Residual Value of Investment	$614,347
Recreational Benefits	-

Input Into BCA Toolkit

Project Useful Life	**30**

Event Damages	**Baseline**	**Project**
50 - year storm	**$1,981,908**	**$904,430**
100 - year storm	**$3,805,964**	**$1,296,244**

Total Benefits from BCA Toolkit	$517,879
Other Benefits (Not Recreation)	$614,347
Recreation Benefits	-
Total Costs	$16,010,987
Net Benefits	-$14,878,760
Net Benefits with Recreation	-$14,878,760
Final BCR	**0.1**
Final BCR with Recreation	**0.1**

Attachment 3

Environmental Constraints Report

Firm Registration No. 312

Environmental Constraints Analysis

Piney Creek Benching Project

for

City of Bastrop, Texas

Prepared by

Halff

AVO 43796
April 2023

Table of Contents

List of Figures

1. Introduction

Halff is conducting a hydrologic and hydraulic study for the proposed Piney Creek Benching Project in Bastrop County. The purpose of the project is to reduce the overtopping depth of Piney Creek at multiple roadway crossings. These roadways include Reids Bend, North Main Street, Riverwood Drive, and Highway 95 North. The study area encompasses approximately 70 acres (see **Appendix A** - **Figures 1.0 and 2.0**).

2. Summary of Environmental Constraints

Halff prepared this Environmental Constraints Analysis that summarizes the potential environmental constraints and permitting requirements associated with the proposed project. Reviewed data sources include Texas Parks and Wildlife Department (TPWD), U.S. Fish and Wildlife Service (USFWS), U.S. Geological Survey (USGS), and Natural Resource Conservation Service (NRCS) and Topoview. No site visit was conducted to assess environmental constraints.

2.1 AERIAL IMAGERY DESCRIPTION

Aerial imagery maps for 2022 were reviewed and depict the study area as primarily made up of a riparian woodland corridor adjacent to Piney Creek. Four roadways and one railroad intersect the study area. Highway 95 North intersects the northeastern portion of the study area, North Main Street intersects the central portion, Magnolia Street intersects the western portion, and Riverwood Drive intersects the southernmost portion of the study area. The study area is surrounded by urban developments within the city of Bastrop to the south and developed herbaceous land to the north.

2.2 TOPOGRAPHIC MAP DESCRIPTION

The USGS topographic map for 2022 depicts the study area as containing primarily undeveloped land largely made up of a riparian woodland corridor (depicted by green shading) adjacent to Piney Creek (depicted by dashed blue line) (see **Figure 3.0**). The study area intersects four roadways and one railroad crossing (at the southernmost boundary of the study area, crossing over Piney Creek). Urban development is depicted within the city of Bastrop to the south of the study area.

2.3 WATER RESOURCES

Water resources includes surface water features (e.g., wetlands, tributaries, rivers, impoundments, and other potential waters of the United States), floodplains and groundwater features. Water resources within the study area were evaluated to identify local, state, and/or federal permitting requirements that may be associated with construction of the proposed project.

Wetlands are identified as areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Based on the review of USFWS National Wetlands Inventory (NWI) data and USGS National Hydrography Dataset (NHD) data, surface water features within the study area include one freshwater forested/shrub wetland, one freshwater emergent wetland, and one riverine feature (Piney Creek) (see **Figure 4.0**).

Site visits will be required to define the spatial limits of aquatic features located within the study area. These aquatic features include Piney Creek, one freshwater emergent wetland, and one freshwater forested/scrub-shrub wetland.

Federal Emergency Management Agency (FEMA) floodplain data were reviewed to evaluate the location of the mapped floodplains in relation to potential aquatic resources located within the study area. According to the FEMA National Flood Hazard Layer (NFHL) dataset, the entire study area is located within the 1-percent annual chance flood hazard (100-year floodplain) zone. The FEMA NFHL Map depicts the floodplain limits within the study area (see **Figure 5.0**).

2.4 BIOLOGICAL RESOURCES

The USFWS Information for Planning and Consultation (IPaC) report for the study area includes eleven federally listed species that should be considered in an effects analysis for the project. Critical habitats are specific geographic areas that contain features essential for the conservation of a threatened or endangered species and that may require special management and protection. There is one USFWS-designated critical habitat mapped within the study area for the Houston toad (*Bufo houstonensis*) which is listed as federally endangered by USFWS (see **Figure 6.0**).

The TPWD Rare, Threatened, and Endangered Species of Texas (RTEST) list for Bastrop County includes 65 species that are state listed or species of greatest conservation need. A Texas Natural Diversity Database (TXNDD) search was also conducted on March 6, 2023. The TXNDD search identified one element occurrence record (records of sightings of rare or endangered species) for the Texas garter snake within 2 miles of the study area (see **Figure 6.0**).

USFWS and TPWD data cannot substitute for on-site evaluations conducted by qualified biologists. A field visit by a qualified biologist is recommended prior to construction to determine the potential effects and impacts to protected species.

2.5 GEOLOGY

Surface geology data derived from the USGS Texas Geology database were reviewed to identify rock units within the study area. One rock unit, Fluviatile terrace deposits (Qt), was identified within the study area (see **Figure 7.0**).

2.6 SOIL SURVEY

Soil data for the study area were obtained from the NRCS Web Soil Survey, which is derived from the U.S. Department of Agriculture (USDA) Soil Survey for Bastrop County, Texas. Soil units within the study area are shown atop an aerial imagery map in **Figure 8.0**. **Table 1** describes characteristics of these soil types.

Table 1: Soil Units within the Study Area

Soil Unit	Topography	Frequency of Flooding	[Hydrologic Soil Group]
Sm – Smithville fine sandy loam	0-1% slopes	None	B
Bo – Bosque loam	0-1% slopes	Occasionally flooded	B
SeD2 – Shep clay loam	3-8% slopes	None	B
No – Weswood silty clay loam	3-8% slopes	None	B
Sa – Sayers fine sandy loam	0-1% slopes	Occasionally flooded	A
AfC2 – Edge fine sandy loam	2-5% slopes	None	D

Note: Hydric soil groups are a classification system defined by NRCS in which soils are categorized into four runoff potential groups.

- Group A: High permeability, little to no runoff potential (>90% sand and <10% clay).
- Group B: High permeability, moderately low runoff potential (50-90% sand and 10-20% clay).
- Group D: Low permeability, high runoff potential (<50% sand and >40% clay).

2.7 CULTURAL RESOURCES

Because the project is being developed by the City of Bastrop, a political sub-entity of the State of Texas, it falls under purview of the Antiquities Code of Texas (Title 9, Chapter 191 of the Texas Natural Resources Code), which requires the Texas Historical Commission (THC) to review actions that have the potential to impact archeological historic properties within the public domain. The project is currently in the planning stages and is evaluating potential channel benching as a flood mitigation solution within the 69.8-acre study area.

Halff conducted desktop research to determine the potential for the project to impact archeological historic properties eligible for listing on the National Register of Historic Places (NRHP) or State Antiquities Landmark (SAL) designation. The Texas Archeological Sites Atlas maintained by the Texas Historical Commission (THC Atlas) was reviewed to determine whether any archeological historic properties, NRHP properties/districts, SALs, cemeteries, Official Texas Historical Markers (OTHMs), and previous cultural resource surveys are documented within or adjacent to the study area.

THC Atlas Review

The review of the THC Atlas records revealed that there is one NRHP property (a late-19th century bridge) is documented within the study area, the majority of which has not undergone previous cultural resources surveys. In addition, two archeological historic properties have been documented in the surrounding 1-kilometer (km) vicinity. A list and description of the previously recorded archeological historic properties identified in the study area and surrounding 1-km radius is provided below in **Table 2**. The NRHP property documented in the study area consists of a cast iron truss bridge over Piney Creek that dates from 1875–1899. The property is eligible under NRHP Criterion A for its association with historic events and significance as the oldest remaining 19th century bridge in the city of Bastrop.

Table 2: Cultural resources within the study area and 1-km radius (THC Atlas 2023).

Resource ID	Resource Type	Chronology	Explanation of Resource	NRHP/ SAL Eligibility	Distance from Study Area	Year(s) Recorded
41BP81	Open campsite	Paleo Indian and Late Archaic	Scattered lithic debitage representing all stages of reduction including flakes, cores, and projectile points	Ineligible	140 meters (m)	1977, 1992
41BP82	Historic structure	Late-19th – early-20th century	Scattered bricks from chimney and sandstone piers with scattered artifacts	Undetermined	20 m	1977
78003292	NRHP Property	1875-1899	Truss iron bridge made by Missouri Valley Bridge & Ironworks	Listed NRHP	0 m	1978

3. Conclusions

Based on the assessment of potential environmental constraints within the study area, additional actions regarding potential environmental impacts may be required. These actions are included in **Appendix B**. The study area contains aquatic resources which may be regulated as waters of the United States (WOTUS) by the U.S. Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act (Section 404). Aquatic resources within the study area including Piney Creek may be considered WOTUS to the extent of the ordinary high water mark (OHWM), and adjacent wetlands where present. To facilitate avoidance of these resources, Halff proposes to perform an on-the-ground delineation of aquatic resources within the study area in accordance with the USACE "Wetland Delineation Manual, Technical Report Y-87-1" and the "Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version 2.0)." Additionally, to demonstrate compliance with the Endangered Species Act (ESA), Halff proposes to conduct a threatened and endangered species and habitat (T&E) assessment, which includes an evaluation of federal and state-listed threatened and endangered species for Bastrop County.

3.1 WATER AND BIOLOGICAL RESOURCES

At a minimum, recommended additional studies include a WOTUS delineation, and a T&E assessment. The WOTUS delineation would include employing GPS surveying techniques per USACE Fort Worth District's operating procedures to delineating the limits of potential WOTUS, including wetlands; completing necessary wetland data forms and take on-site photography for representative site features; and, preparing draft and final reports describing the methodology and results of the investigation, so that the report may satisfy the jurisdictional determination requirement for future permits, if necessary. Geographic Information System shapefiles of the field data collected will be provided with the final report. The T&E assessment would include an effects determination for species occurring within the study area. The effect determination would identify whether any listed species are likely to be present; whether the project affects or has the potential to affect federal-listed species; and Halff shall address the best management practices for avoiding impacts to other wildlife during construction, specifically migratory birds and bald and golden eagles. At this phase of project development, the preliminary cost estimate for these additional studies is $28,000.

3.1 CULTURAL RESOURCES

The desktop review revealed that future proposed ground disturbing activities within the study area could impact one NRHP property given its location within the study area and previously documented archeological historic property 41BP82 given its proximity to the study area. In addition, ground disturbing construction activities within the study area could impact undocumented cultural resources given that the majority has not been previously surveyed and is within an environmental setting that is considered conducive to past human occupation and activity. Therefore, cultural resources surveys will be required prior to any proposed ground disturbing activity within the study area to comply with the Antiquities Code of Texas (ACT). In addition, compliance with Section 106 of the National Historic Preservation Act (Section 106) would be required should the project require any federal funding or permitting. It is Halff's recommendation that direct or indirect effects to the NRHP property documented within the study area should be avoided.

3.1.1 Additional services

The above-described cultural resources services will be implemented when the extent of ground disturbing activities have been identified (e.g., during the project design phases). Compliance with the ACT and Section 106 will at minimum require direct coordination with the THC and submittal of an ACT permit application and scope of work to perform the required field investigations in the study area. Upon issuance of the ACT permit number assigned to the project by the THC, Halff will conduct an intensive cultural

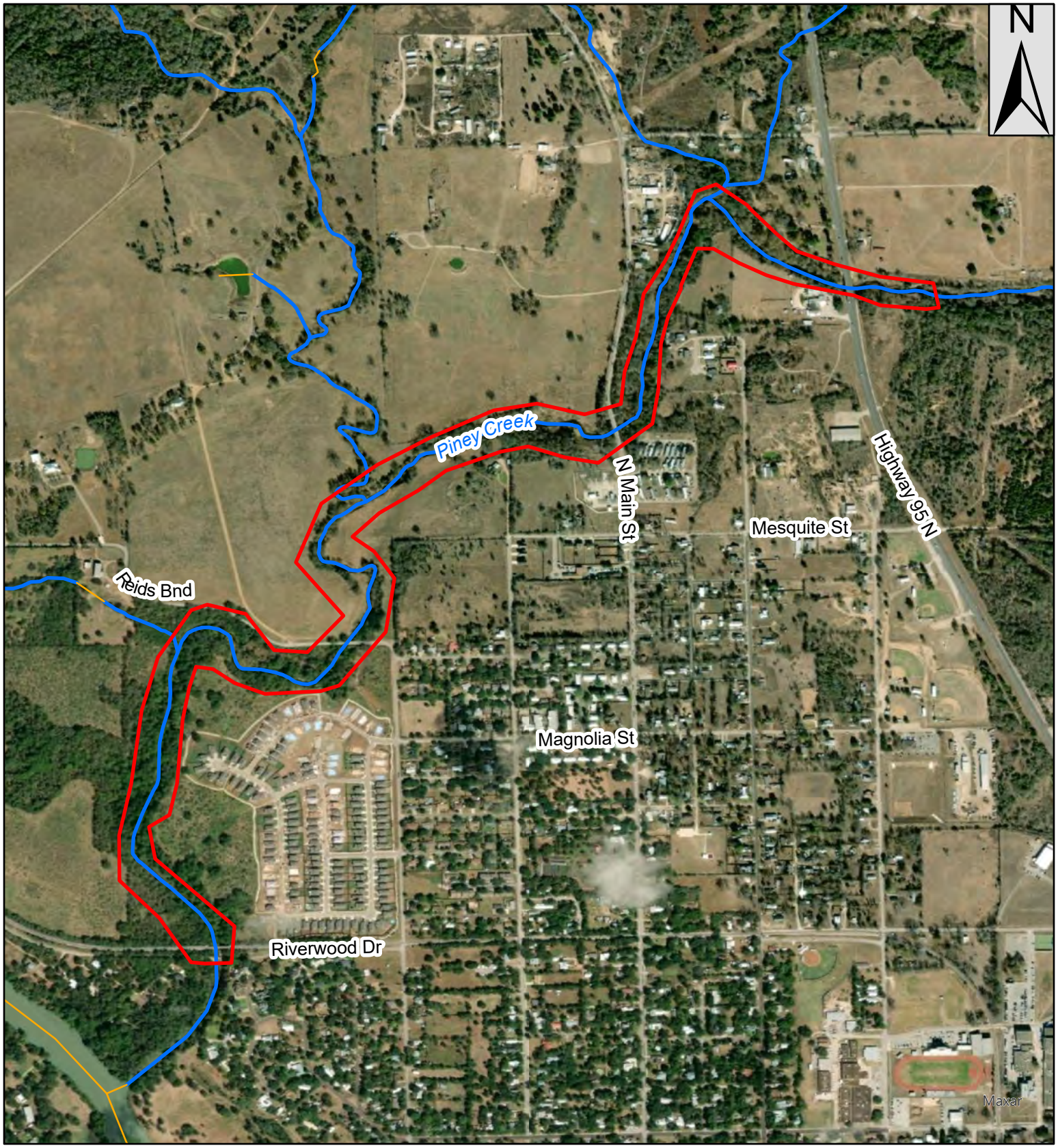
resources survey that conforms to the standards outlined by the Council of Texas Archeologists and approved by the THC. The survey will be performed by Halff archeologists who meet the U.S. Secretary of the Interior's (SOI) Professional Qualification Standards for Archeology and Historic Preservation under the direction of an SOI-qualified Principal Investigator. The survey may include pedestrian reconnaissance, shovel testing and mechanized trenching within the proposed study area, depending on the extent of proposed ground disturbance. For example, if proposed construction activities are greater than 3 feet in depth, mechanized trenching may be required to test for deeply-buried archeological sites. An SOI-qualified architectural historian will perform an effects assessment of any above-ground historic-age resources (i.e., greater than 50 years old) identified within or adjacent to the study area, including the NRHP listed bridge.

At the conclusion of the field survey, Halff will prepare and submit a draft report that conforms to the SOI Guidelines for Archaeology and Historic Preservation. The report will summarize the findings of the cultural resources survey, provide recommendations regarding any effects to archeological historic properties and determine whether additional ACT or Section 106 compliance is required. Following a period of City review, the draft report will be submitted for review by THC and all other applicable state/federal agencies as needed. After acceptance of the draft report by the THC, a final report will be submitted and all field records, photographs and collected artifacts will be prepared for permanent curation at the Center for Archaeological Studies located at Texas State University in San Marcos, Texas.

The preliminary cost estimate for the cultural resources services described above is $30,000, which is subject to change based on the project design. Any further ACT and Section 106 requirements, including but not limited to formal NRHP/SAL eligibility evaluations of archeological historic properties discovered in the study area, and the documentation, exhumation or repatriation of human burials discovered in the study area would be scoped separately as additional services.

Appendix A – Figures

Appendix B – Environmental Constraints Table



Legend

Study Area

NHD

Stream/River

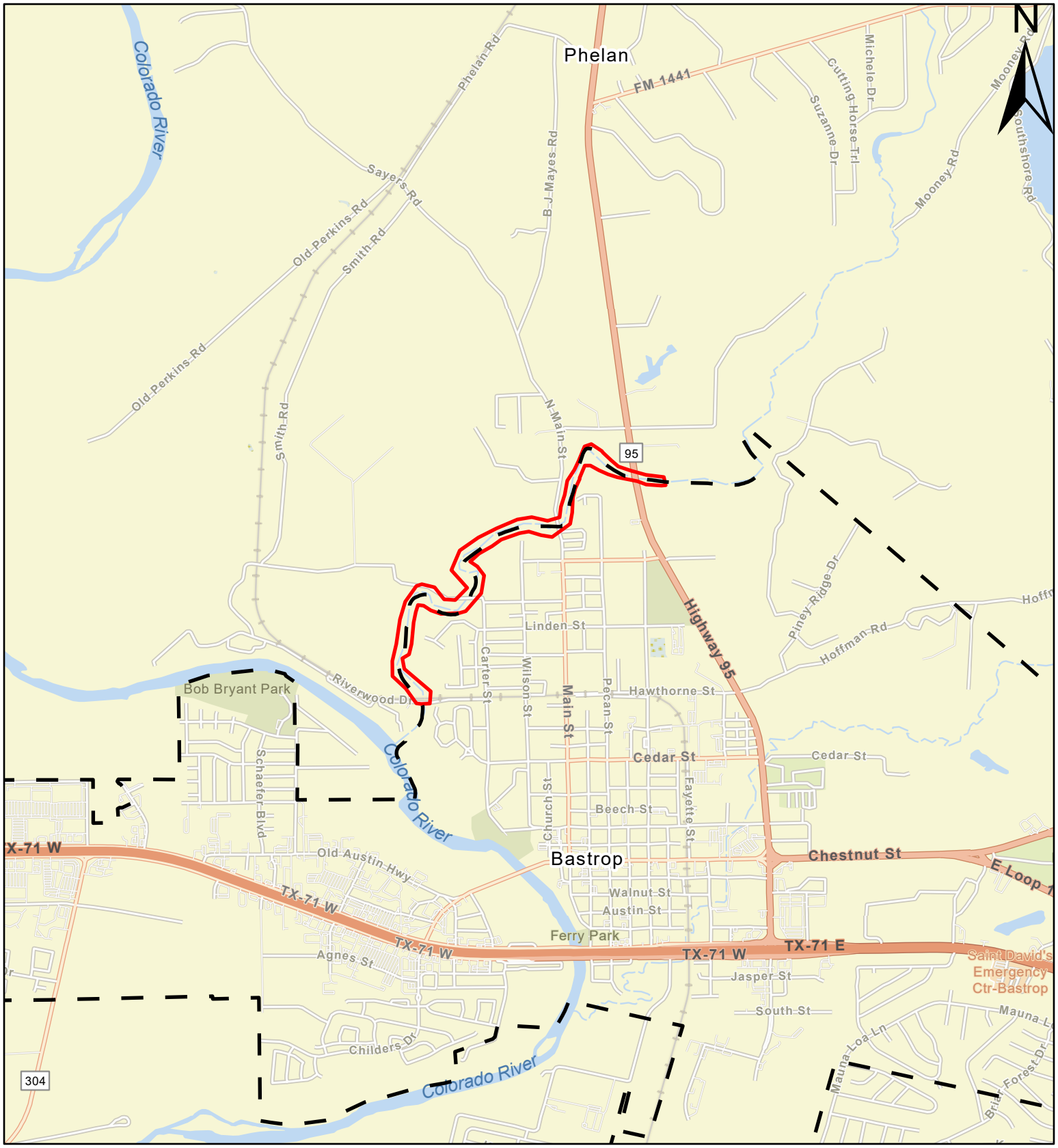
Artificial Path

0 500 1,000 2,000 Feet

Notes:
1. Map Center: 97.32256°W 30.12853°N
2. World Imagery: Maxar, Microsoft
3. USGS National Hydrography Dataset

Piney Creek Benching Project
Bastrop County, Texas
Figure 1.0 - Location Map
AVO: 43796
Date: 3/20/2023

halff



Legend

- Study Area
- City Boundary

0 1,500 3,000 6,000 Feet

Notes:
1. Map Center: 97.32256°W 30.12853°N
2. World Street Map: Baylor University, Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/ NASA, USGS, EPA, NPS, US Census Bureau, USDA
3. TXDOT City Boundaries

Piney Creek Benching Project
Bastrop County, Texas
Figure 2.0 - Vicinity Map
AVO: 43796
Date: 3/20/2023

halff

Legend

Study Area

0 500 1,000 2,000 Feet

Notes:
1. Map Center: 97.32256°W 30.12853°N
2. topoview - "Bastrop, Texas; Lake Bastrop, Texas" USGS Quadrangle 2022

Piney Creek Benching Project
Bastrop County, Texas
Figure 3.0 - 2022 USGS Topographic Map
AVO: 43796
Date: 3/9/2023

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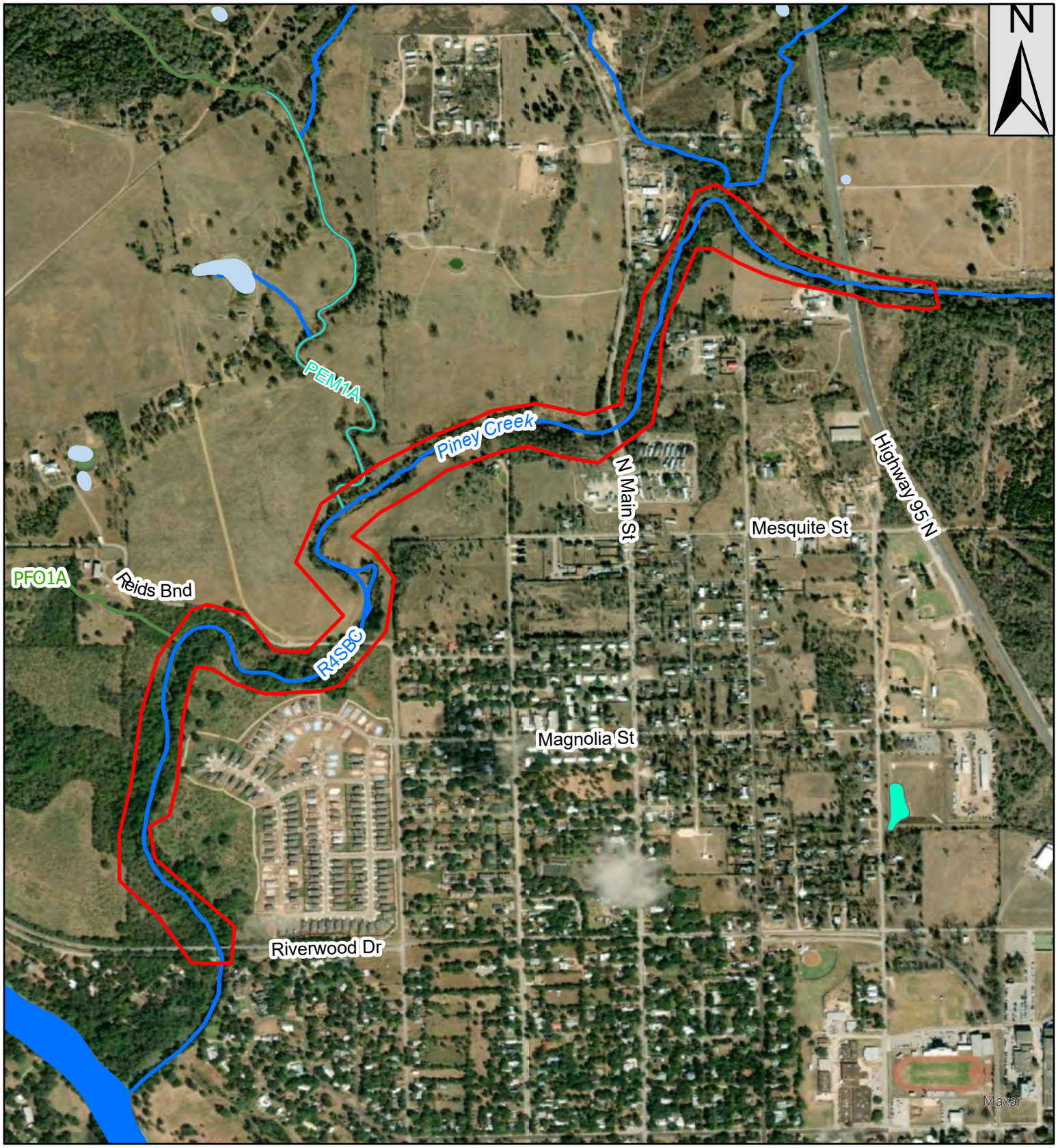

Legend

Study Area

NWI

- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Riverine

NHD

- Stream/River
- Artificial Path

0 500 1,000 2,000 Feet

Notes:
1. Map Center: 97.32256°W 30.12853°N
2. World Imagery: Maxar, Microsoft
3. USFWS National Wetland Inventory
4, USGS National Hydrography Dataset

Piney Creek Benching Project
Bastrop County, Texas
Figure 4.0 - NWI/NHD Map
AVO: 43796
Date: 3/20/2023

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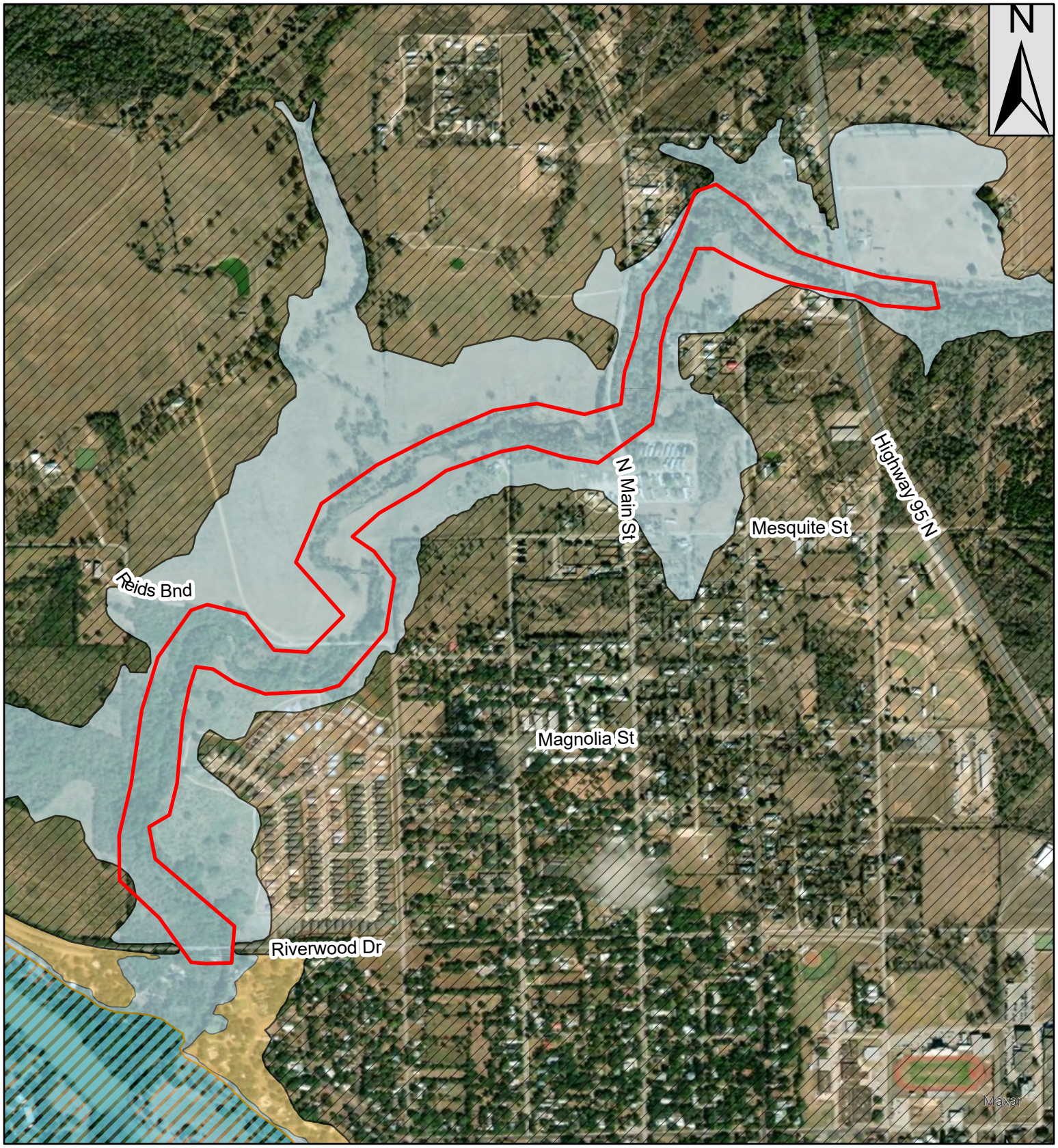

Legend

Study Area

FEMA NFHL

0.2% Annual Chance Flood Hazard

1% Annual Chance Flood Hazard

Area of Minimal Flood Hazard

FLOODWAY

0 500 1,000 2,000 Feet

Notes:
1. Map Center: 97.32256°W 30.12853°N
2. World Imagery: Maxar, Microsoft
3. FEMA NFHL Layer

Piney Creek Benching Project
Bastrop County, Texas
Figure 5.0 - FEMA NFHL Map
AVO: 43796
Date: 3/20/2023

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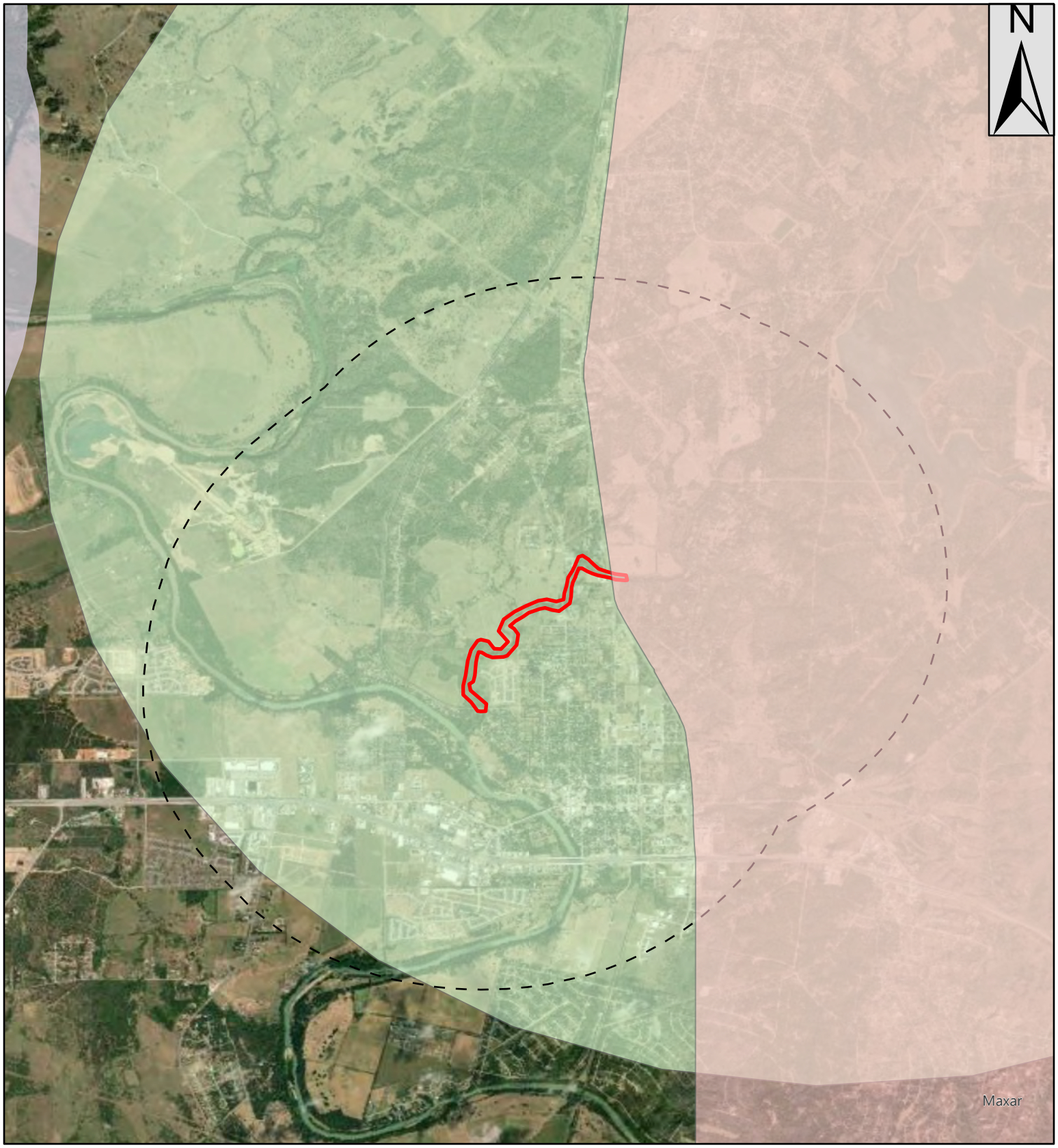


Legend

- Study Area
- 2-Mile Buffer

TPWD TXNDD Species Occurrence

- Texas garter snake
- Bald eagle

USFWS Species Critical Habitat

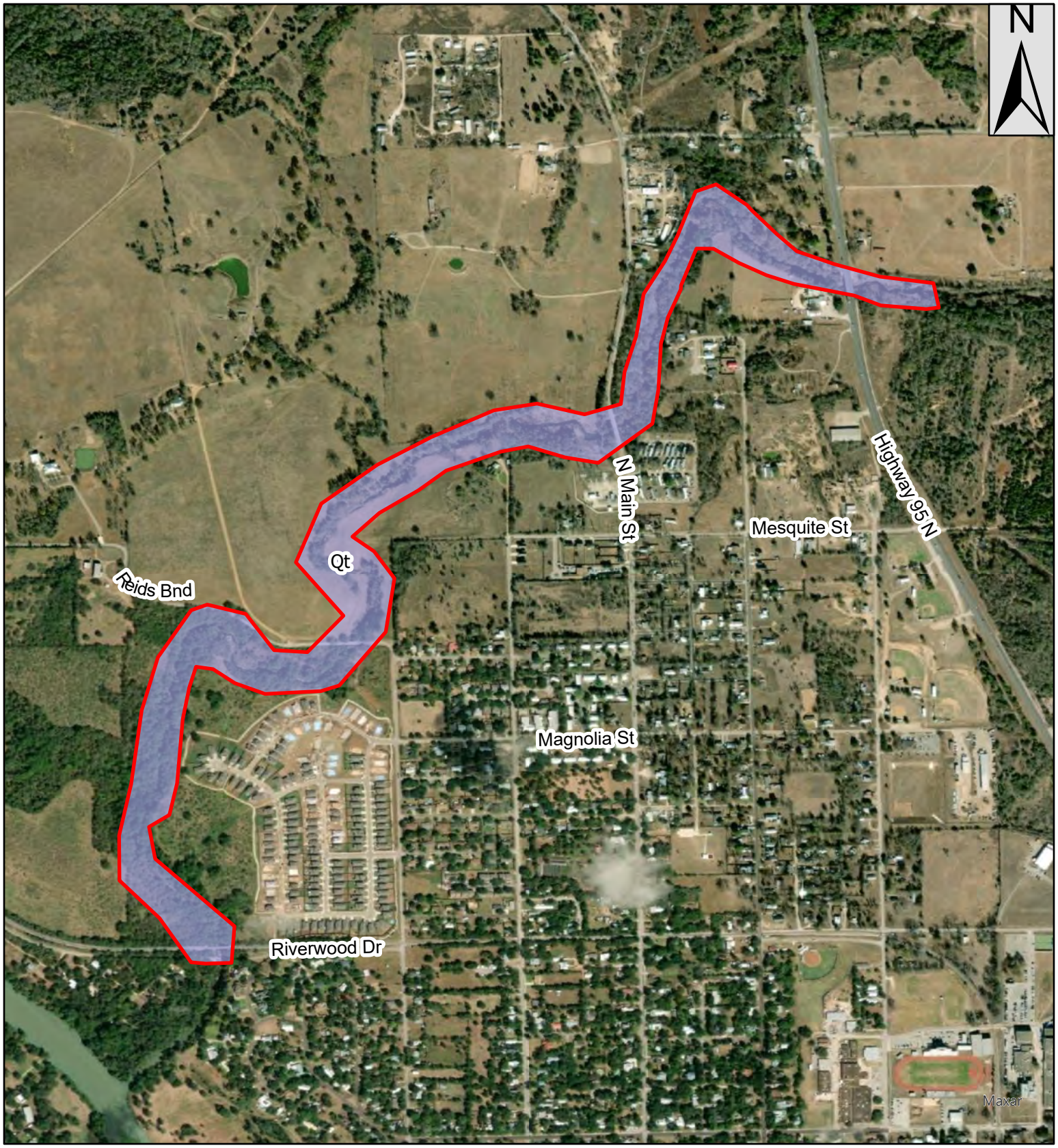
- Houston toad

0 2,500 5,000 10,000 Feet

Notes:
1. Map Center: 97.32425°W 30.13474°N
2. World Imagery: Maxar, Microsoft
3. TPWD TXNDD Element Occurrence
4. USFWS Critical Habitat Database

Piney Creek Benching Project
Bastrop County, Texas
Figure 6.0 - TPWD TXNDD Map
AVO: 43796
Date: 3/20/2023

halff



Legend

Study Area

USGS Rock Unit

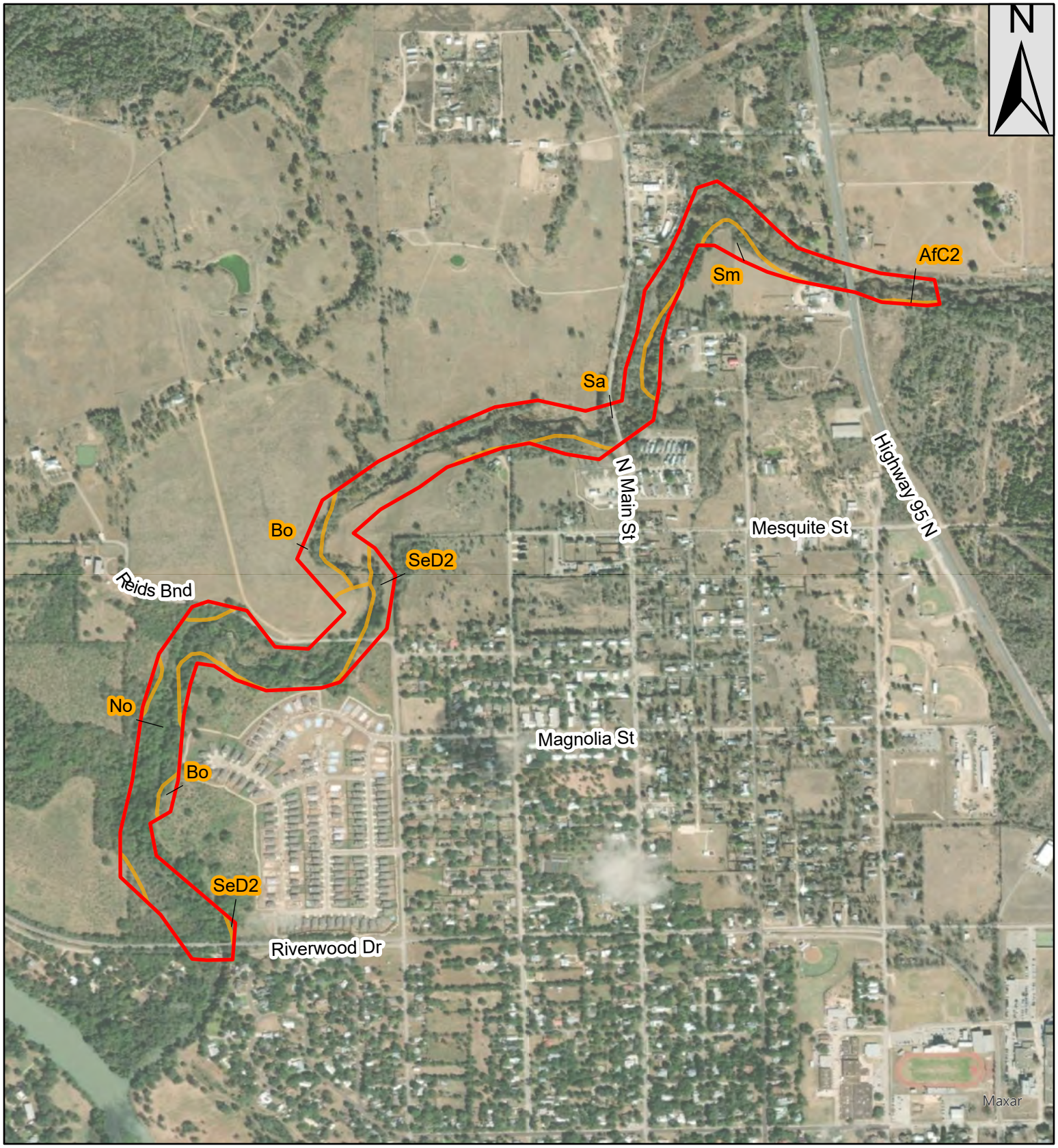
Fluvial terrace deposits (Qt)

0 500 1,000 2,000 Feet

Notes:
1. Map Center: 97.32256°W 30.12853°N
2. World Imagery: Maxar, Microsoft
3. USGS Geology of Texas

Piney Creek Benching Project
Bastrop County, Texas
Figure 7.0 - USGS Geologic Rock Unit Map
AVO: 43796
Date: 3/20/2023

halff



Legend

- Study Area

NRCS Soils

- Edge fine sandy loam (AFC2)
- Bosque loam (Bo)
- Weswood silty clay loam (No)
- Sayers fine sandy loam (Sa)
- Shep clay loam (SeD2)
- Smithville fine sandy loam (Sm)

0 500 1,000 2,000 Feet

Notes:
1. Map Center: 97.32258°W 30.12846°N
2. World Imagery: Maxar, Microsoft
3. USDA Web Soil Survey NRCS SSURGO

Piney Creek Benching Project
Bastrop County, Texas
Figure 8.0 - NRCS Soil Map
AVO: 43796
Date: 3/20/2023

halff

Environmental Constraints Table

Resource / Regulating Entity (or Policy)	Database Review	Database Findings	Applicable Regulations & Following Steps
Water Resources			
Jurisdictional Waters of the U.S. / U.S. Army Corps of Engineers (USACE), Section 404 of the Clean Water Act (CWA)	Data from the National Hydrography Dataset, The USFWS National Wetland Inventory (NWI), aerial imagery and LiDAR data were reviewed to identify mapped surface waters and wetlands within the study area. The database review is utilized only as a general guide to the potential location of aquatic resources and does not substitute for site surveys to identify and delineate streams and wetlands regulated under Section 404.	NHD data shows Piney Creek within the study area. The study area contains NWI-mapped wetlands.	• The USACE regulates activities within jurisdictional waters, such as streams, rivers and lakes. • Conduct a site survey to identify any USACE regulated water features and delineate boundaries. • Follow USACE permitting procedures under Section 404 of the CWA, if applicable. • Depending on the nature of activity, activities that result in the placement of fill within waters of the U.S. under ½-acre or below 300 linear feet are generally authorized under a nationwide permit. A pre-construction notification and compensatory mitigation may be required. Impacts to waters of the U.S. above these thresholds may require an individual permit.
Floodplains / Federal Emergency Management Agency (FEMA)	Digital data derived from FEMA Flood Insurance Rate Maps were reviewed.	The majority of the study area is located within the 100-year floodplain (Zones A, AE).	• Comply with FEMA floodplain regulations and local ordinances, and coordinate with the local floodplain administrator. • If federal funding is utilized, comply with Executive Order (EO) 11988.

Environmental Constraints Table

Resource / Regulating Entity (or Policy)	Database Review	Database Findings	Applicable Regulations & Following Steps
Impaired Assessment Units / TCEQ, Section 303(d) of the CWA	The 2020 Texas Integrated Report – Texas 303(d) List was reviewed in conjunction with TCEQ geospatial data to determine if any impaired assessment units occur within the study area.	No impaired assessment units occur within the study area.	No applicable regulations or following steps.
Biological Resources			
Protected Species / USFWS	A USFWS Information for Planning and Consultation (IPaC) Trust Resource Report was generated for Bastrop County.	According to data in the IPaC report, four bird species, two amphibian species, one insect species, three arachnid species, and one plant species are federally listed as either threatened or endangered in Bastrop County. One insect species is as a candidate for listing, and four clam species are proposed threatened or endangered.	• The Endangered Species Act (ESA) regulates for the protection of habitat and species. • Based on the report findings and a review of aerial photography, the study area has the potential to contain habitat for listed species. • A site visit, conducted by a qualified biologist, should occur to determine if habitat for listed species is present within the footprint of the proposed roadway project.

Environmental Constraints Table

Resource / Regulating Entity (or Policy)	Database Review	Database Findings	Applicable Regulations & Following Steps
Critical Habitat / USFWS	The USFWS Critical Habitat for Threatened & Endangered Species online mapper was reviewed.	Critical habitat for the Houston toad (*Bufo houstonensis*) is mapped within the study area.	• The ESA identifies critical habitat for listed species. • Based on review of mapped critical habitat and review of aerial photography, the study area has the potential to contain habitat for the Houston toad. • A site visit, conducted by a qualified biologist, should occur to determine if habitat for listed species is present within the footprint of the proposed roadway project. • Due to the occurrence of critical habitat within the study area, if the project will impact WOTUS then a pre-construction notice (PCN) will be required. • If a PCN is necessary, a biological assessment and correspondence with USFWS will be included as a part of the PCN package.

Environmental Constraints Table

Resource / Regulating Entity (or Policy)	Database Review	Database Findings	Applicable Regulations & Following Steps
Rare, Threatened, and Endangered Species of Texas (RTEST) / TPWD	The TPWD's RTEST by County lists were reviewed for Bastrop County. TPWD's Texas Natural Diversity Database data were obtained for the study area.	There are 65 species listed on TPWD's RTEST list for Bastrop County that include the following: Amphibians (5), birds (13), crustaceans (1), fish (5), insects (7), mammals (13), mollusks (2), reptiles (9), plants (10). One element occurrence record for the Texas garter snake (SGCN) is located within the study area.	• The Texas Parks and Wildlife (TPW) Code and Texas Administrative Code (TAC) protect state-listed species and prohibit take of state-listed species. Comply with TPW Code and the TAC for laws and regulations pertaining to endangered or threatened species. • Based on the report findings and a review of aerial photography, the study area has the potential to contain habitat for listed species. • A site visit, conducted by a qualified biologist, should occur to determine if habitat for listed species is present within the footprint of the proposed roadway project.
Wildlife Management Areas / TPWD	The TPWD's wildlife management areas (WMAs) were reviewed.	No WMAs occur within the study area.	No applicable regulations or following steps.
Farmland / Natural Resources Conservation Service (NRCS),	The U.S. Department of Agriculture (USDA) NRCS Web Soil Survey was utilized to identify prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland within the study area.	Portions of the study area are not located within an urbanized area. Based on the soil survey, soils mapped as prime farmland or farmland of statewide importance are not mapped within the study area.	No applicable regulations or following steps.