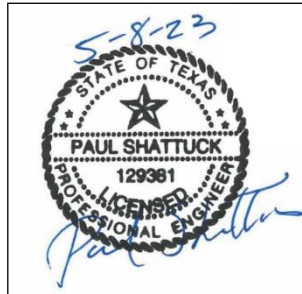


Flood Management Evaluation Memorandum

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

DATE: May 8, 2023

FROM: Paul Shattuck, PE
HDR, Inc.
Firm No. 754
4401 W Gate Blvd Ste 400
Austin, TX 78745



PROJECT: LCRA Contract No. 5809
Half AVO 43796.001
HDR PN 10304676

SUBJECT: **FME ID: 101000116/165**

Project Sponsor: City of Marble Falls (Municipality)

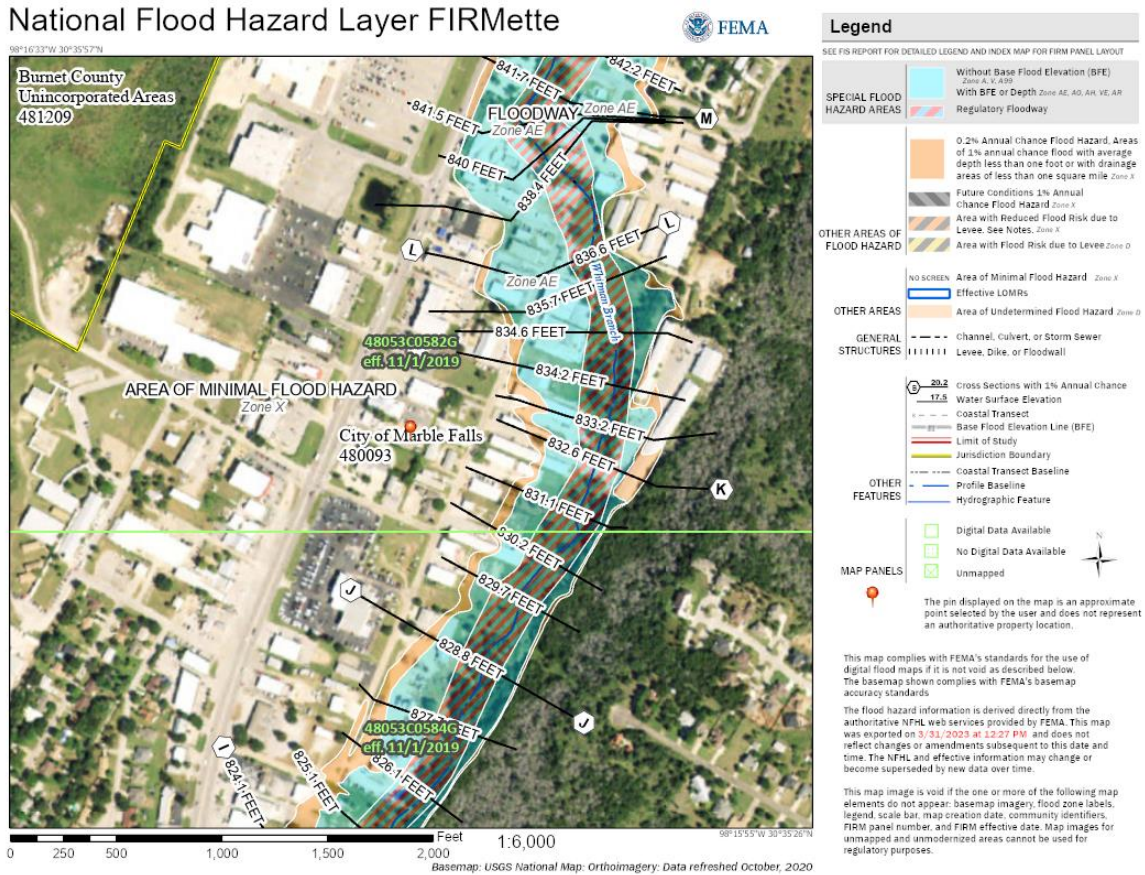
Project Name: Whitman Branch Regional Stormwater Detention FMP

On September 15, 2022, the Lower Colorado-Lavaca Regional Flood Planning Group (RFPG) approved the execution of this Flood Management Evaluation (FME) to identify, evaluate and recommend additional potentially feasible Flood Mitigation Projects (FMP). This alternatives analysis is produced to inform The City of Marble Falls (Marble Falls or Project Sponsor) of possible flood risk reduction solutions, their feasibility, impacts, costs, and benefits. The alternatives analysis recommends a regional stormwater detention solution to be adopted by Marble Falls and sponsored in the Regional Flood Plan.

Introduction

This FME evaluates multiple potential flood mitigation alternatives for the chronic flood problems associated with Whitman Branch in or near the industrial area along Commerce Street between US 281 and the Nature Heights area within the City of Marble Falls. These areas are located directly adjacent to Whitman Branch which has a designated Zone AE special flood area with a floodway as shown in Figure 0-1. These areas sustained heavy flood damages in 2007. Potential alternatives evaluated include regional stormwater detention, channel modifications of the existing Whitman Branch natural channel, two flood bypass concepts, and property acquisitions.

Figure 0-1: Study Area Location – FEMA Map



Modeling Analysis

Data Collection and Site Visits

The following data was collected and leveraged in the analysis process:

- Terrain Data: USGS 2019 – 1 meter, Hurricane Lidar, Stratmap 2020 – North & Central Texas Lidar
- Soils Data: 2019 Natural Resource Conservation Service (NRCS) Web Soil Survey
- Land Use Data: Determined from Aerial Imagery – CAPCOG 2022
- Relative Finished Floor Height: Site Visit March 10, 2023

Hydrology

A HEC-HMS hydrologic model of Backbone Creek, which includes Whitman Branch, was provided to HDR from Halff and Associates and is the best available model at the time of the analysis. This model was developed circa 2014 as part of a flood study by Halff and Associates for the City of Marble Falls. This HEC-HMS model is believed to match the regulatory model for Backbone Creek because the model output matches the regulatory HEC-RAS hydraulic model flow inputs. The model includes basin models representing both existing and fully developed conditions of Backbone Creek. Only the fully developed basin model was used for this FMP. The provided HMS model was updated to include Atlas 14 rainfall.

- Modeling Software: HEC-HMS version 3.5

- Rainfall Data: NOAA Atlas 14, 24-hour duration, frequency storm temporal distribution
- Initial Losses: NCRS Curve Number Method. Loss statistics were not revised or verified for this study. Basin model representing ultimate / fully developed conditions was used.
- Hydrograph Approach: SCS unit hydrograph. This methodology was not revised or verified for this study.
- Routing: Provided model utilizes Modified Puls and Muskingum Cunge reach routing methodologies. These values were not revised or verified for this study.
- Areal Reduction: No areal reduction was applied for this FMP. Total contributing area to proposed flood reduction areas is below the 10 square mile threshold for applying TP40 areal reduction factors.

Hydrologic analysis using Atlas 14 precipitation produces expected flows substantially higher than those in regulatory models. The Atlas 14 100-year event for instance has an expected rainfall of 11.4 inches compared to 8.34 inches in the pre-Atlas 14 best available model.

Hydraulics

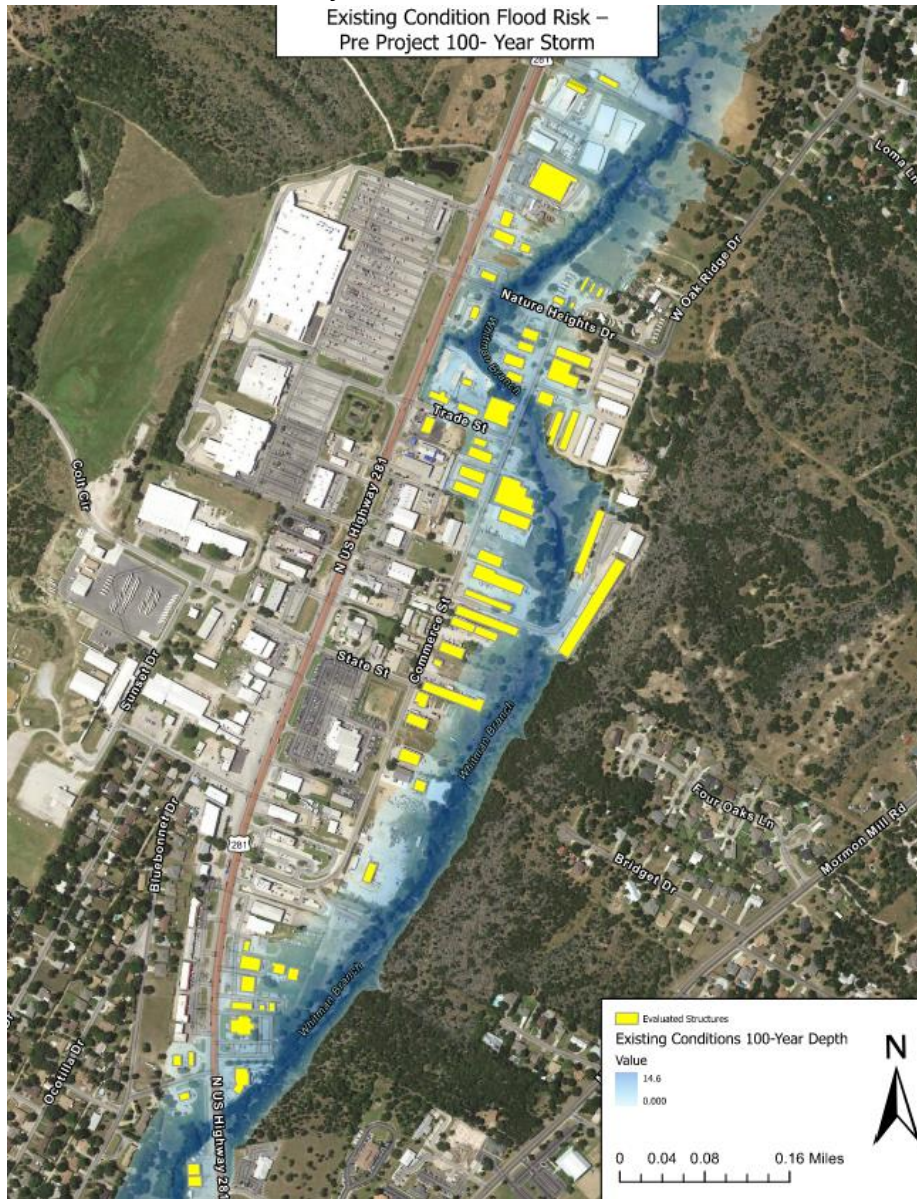
A 2D model was created for evaluation of pre-project (existing flooding conditions), and post-project (FMP proposed) conditions. The regulatory 1D model was evaluated with Atlas 14 flows and was used for informative purposes when creating the 2D model.

- Modeling Software: HEC-RAS version 4.3.1 – 2D unsteady
- Hydrologic Data: Hydrologic model output is applied directly to boundary condition lines on the 2D mesh
- Boundary Conditions: Downstream normal depth. Located at approximate regulatory model river station 5642 where profiles appear to consistently be normal depth.

Existing Condition Flood Risk

The Commerce Street area development is well within the riverine floodplain of Whitman Branch tributary. Existing flood risk to the Commerce Street area is extensive; however, when considering new design storm rainfall estimates, the flooding is deeper and more widespread compared to the effective floodplain mapping. There are approximately 49 commercial and residential buildings that face expected flood risk in the 100-year event, and two existing public roadway low water crossings that will overtop in most day-to-day rainfall events.

Figure 0-2: Existing Condition Flood Risk – Pre Project 100- Year Storm

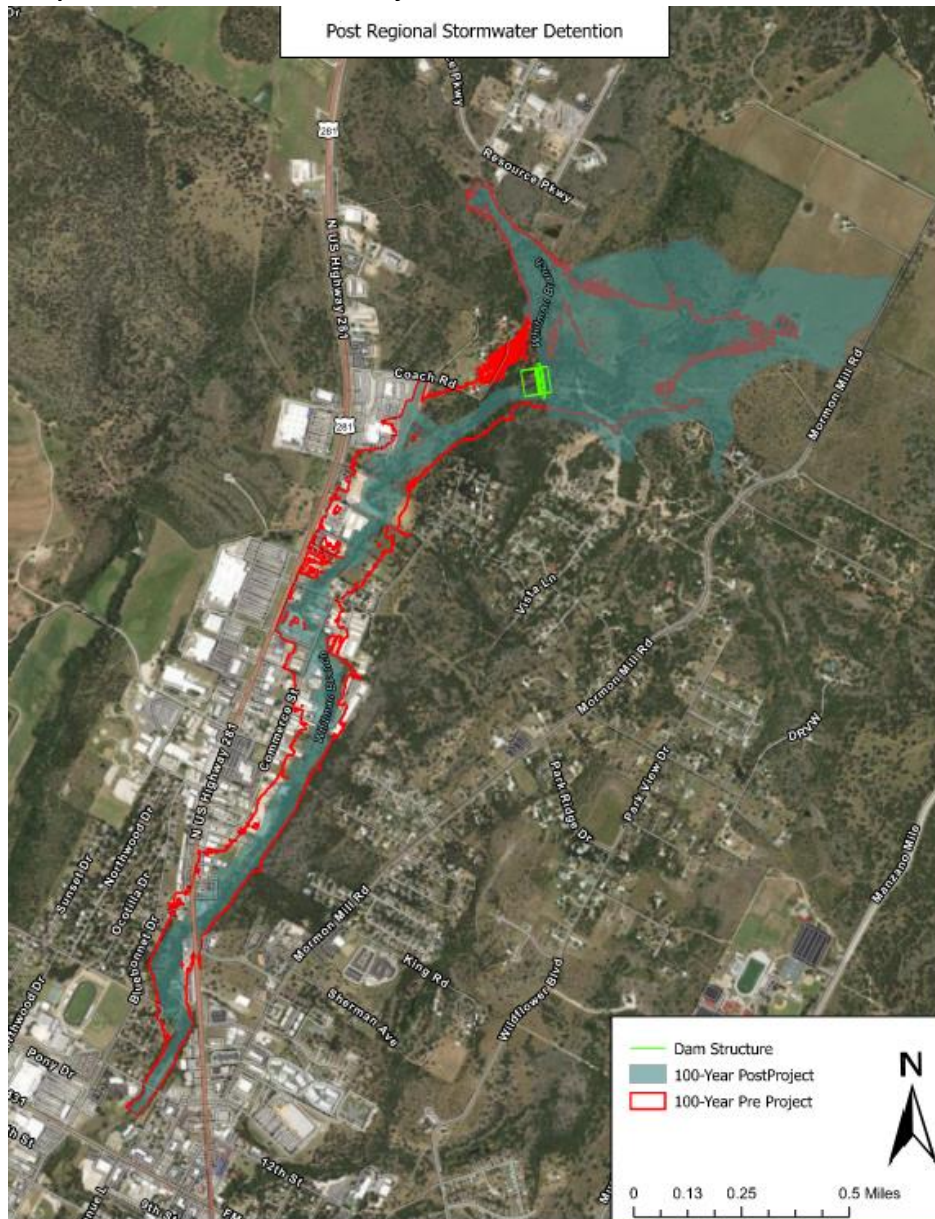


Alternatives Analysis

Alternative 1—Regional Stormwater Detention

This FMP proposes a regional stormwater detention solution to control flows upstream of the Commerce Street area. The solution includes an approximately 36 ft maximum height earthen embankment dam approximately 1750 feet long on Whitman Branch near Coach Drive as shown on Figure 1-1. The reservoir storage volume and outlet works configuration were chosen to provide an approximate 100-year level of protection to the Commerce Street area. The outlet works and any service or auxiliary spillway have not been formally designed or analyzed at this phase, and the modeled reservoir outlet is approximated only with outlet conduit spanning the proposed earthen embankment. The proposed top of dam is set at 890' msl; providing over 10' of freeboard in a 100-year event which approximates expected additional storage requirements for dam safety. Without a geotechnical evaluation, the earthen embankment and dam configuration are approximated.

Figure 1-1: Proposed Improvements – Pre and Post Project Inundation Boundaries



Project Benefits

This detention project would significantly attenuate flows within Whitman Branch upstream of the Commerce Street area resulting in major flood risk reduction benefits downstream. In a 100-year event, expected runoff approaching the flood prone area near the proposed dam outlet would be reduced from an estimated 7,000 cfs to approximately 400 cfs. This reduction in upstream flows would have the net effect of limiting flood risk to occur only from local runoff. There are two local low water crossings and approximately 49 residential and commercial structures that would have significantly reduced flood risk. This FMP would also have the effect of reducing flows at US 281 bridge over Whitman Branch which would no longer overtop in the 10-, 25-, and 100- Year events. US 281 has an average daily traffic of 31,416 vehicles.

Table 1-1: Risk Reduction Benefits

Flood Risk Condition	Number of At-Risk Buildings	Number of At-Risk Roadway Crossings (low water crossings)
Existing Condition 1% Annual Chance (100-year)	49	3
Post-Project Condition 1% Annual Chance (100-year)	11	2

Estimate of Probable Cost

The proposed project total capital cost is estimated to be \$28,000,000 in 2023 dollars. Adjusted for 2020 dollars, the cost of the project would be approximately \$24,000,000. Cost of the project includes construction costs, land acquisition, design and permitting (20%), and contingency (35%). Expected O&M costs are not itemized with capital costs in the cost estimate, but are included in the BCR calculations. The expected annual O&M cost is \$50,000

Table 1-2: Cost Estimate

2023 Lower Colorado Regional Flood Plan: Project Cost Estimate						
Applicant/Subrecipient:	City of Marble Falls					
Site/Activity Title:	Regional Detention Improvements					
Consultant:	HDR Engineering, Inc. TBPE Registration No. F-754					
Date:	4/25/2023					
Eligible Activity:	Flood control and drainage improvements					
Materials/Facilities/Services	\$/Unit	Unit	Quantity	Construction	2023 Cost	2020 Cost (adjusted using ENR CCI)
Mobilization	11%	LS	1	\$ 1,246,300.00	\$ 1,250,000.00	\$ 1,087,754.92
Preparing the Right of Way	\$ 20,000.00	LS	1	\$ 20,000.00	\$ 20,000.00	\$ 17,455.75
Excavation	\$ 30.00	CY	29000	\$ 870,000.00	\$ 870,000.00	\$ 759,325.03
Class C (Topsoil), Plan Quantity	\$ 100.00	CY	8000	\$ 800,000.00	\$ 800,000.00	\$ 698,229.91
Embankment	\$ 50.00	CY	76184	\$ 3,809,200.00	\$ 3,810,000.00	\$ 3,325,319.94
Concrete Spillway Structures	\$ 4,000,000.00	LS	1	\$ 4,000,000.00	\$ 4,000,000.00	\$ 3,491,149.55
6'x6' Culvert (all depths), including excavation and backfill	\$ 750.00	LF	200	\$ 150,000.00	\$ 150,000.00	\$ 130,918.11
Concrete Riprap	\$ 750.00	CY	1800	\$ 1,350,000.00	\$ 1,350,000.00	\$ 1,178,262.97
Soil Retention Blanket Class A; Type G	\$ 5.00	SY	25000	\$ 125,000.00	\$ 130,000.00	\$ 113,462.36
Rock Berm	\$ 31.50	LF	500	\$ 15,750.00	\$ 20,000.00	\$ 17,455.75
Silt Fence for Erosion Control	\$ 6.00	LF	2000	\$ 12,000.00	\$ 10,000.00	\$ 8,727.87
Care of Surface Water	\$ 120,000.00	LS	1	\$ 120,000.00	\$ 120,000.00	\$ 104,734.49
Traffic Control	\$ 50,000.00	LS	1	\$ 50,000.00	\$ 50,000.00	\$ 43,639.37
TOTAL CONSTRUCTION COST					\$ 12,600,000.00	\$ 11,000,000.00
Design and Permitting (20% construction cost)	20%				\$ 2,520,000.00	\$ 2,199,424.21
Environmental; archaeological & historical resources	\$ 1,000,000.00	LS	1		\$ 1,000,000.00	\$ 872,787.39
CLOMR / LOMR Preparation	\$ 60,000.00	LS			\$ 60,000.00	\$ 52,367.24
Legal assistance; fiscal services & costs (bond counsel); outreach (3% construction cost)	3%				\$ 378,000.00	\$ 329,913.63
Interest during construction (*assume 1Yr)	3.5%				\$ 441,000.00	\$ 384,899.24
Inspection; pilot testing; warranty; manuals	6%				\$ 756,000.00	\$ 659,827.26
Contingency(s) (35% construction cost)	35%				\$ 4,410,000.00	\$ 3,848,992.37
Property Acquisition	\$5,300,000.00	LS	1		\$ 5,300,000.00	\$ 4,625,773.15
TOTAL ADDITIONAL COST					\$ 14,900,000.00	\$ 13,000,000.00
TOTAL COST					\$ 28,000,000.00	\$ 24,000,000.00

Project Constraints

This proposed project would have many challenges in potential design and permitting phases. Upstream of the dam is expected to be inundated regularly and private property would need to be purchased to construct, maintain access for service, and contain the expected flood pool elevation. Land acquisition is expected to be approximately 5.3 million dollars.

Permitting would be a major challenge for this project.

- This project would require a USACE Section 404 permit and associated wetland mitigation costs due to construction impacts to regulatory waters of the U.S..

- TCEQ must review and approve the design of the dam which is anticipated to be a high hazard potential dam.
- Local permitting would be required; this dam may fall in jurisdiction of both the City of Marble Falls and Burnet County.
- FEMA compliance and coordination would be required for floodplain mapping and re-modeling.

Operation and maintenance (O&M) activities related to dam safety will be required to remain compliant with TCEQ Dam Safety Program requirements.

Benefit Cost Analysis

Table 1-3: Benefit Cost Analysis

Input Into BCA Toolkit		
Project Useful Life	30	
Event Damages	Baseline	Project
2 - year storm	\$704,806	\$0
10 - year storm	\$7,062,816	\$704,806
100 - year storm	\$27,280,686	\$1,626,163
<hr/>		
Total Benefits from BCA Toolkit	\$28,564,608	
Other Benefits (Not Recreation)	\$1,347,297	
Recreation Benefits	\$962,163	
Total Costs	\$24,162,786	
Net Benefits	\$5,749,119	
Net Benefits with Recreation	\$6,711,281	
Final BCR	1.2	
Final BCR with Recreation	1.3	

No Negative Impact

The project is expected to have only a net reductive effect on maximum discharges and water surface elevations between the proposed reservoir itself and Lake Marble Falls.

The preliminary modeling confirms the following:

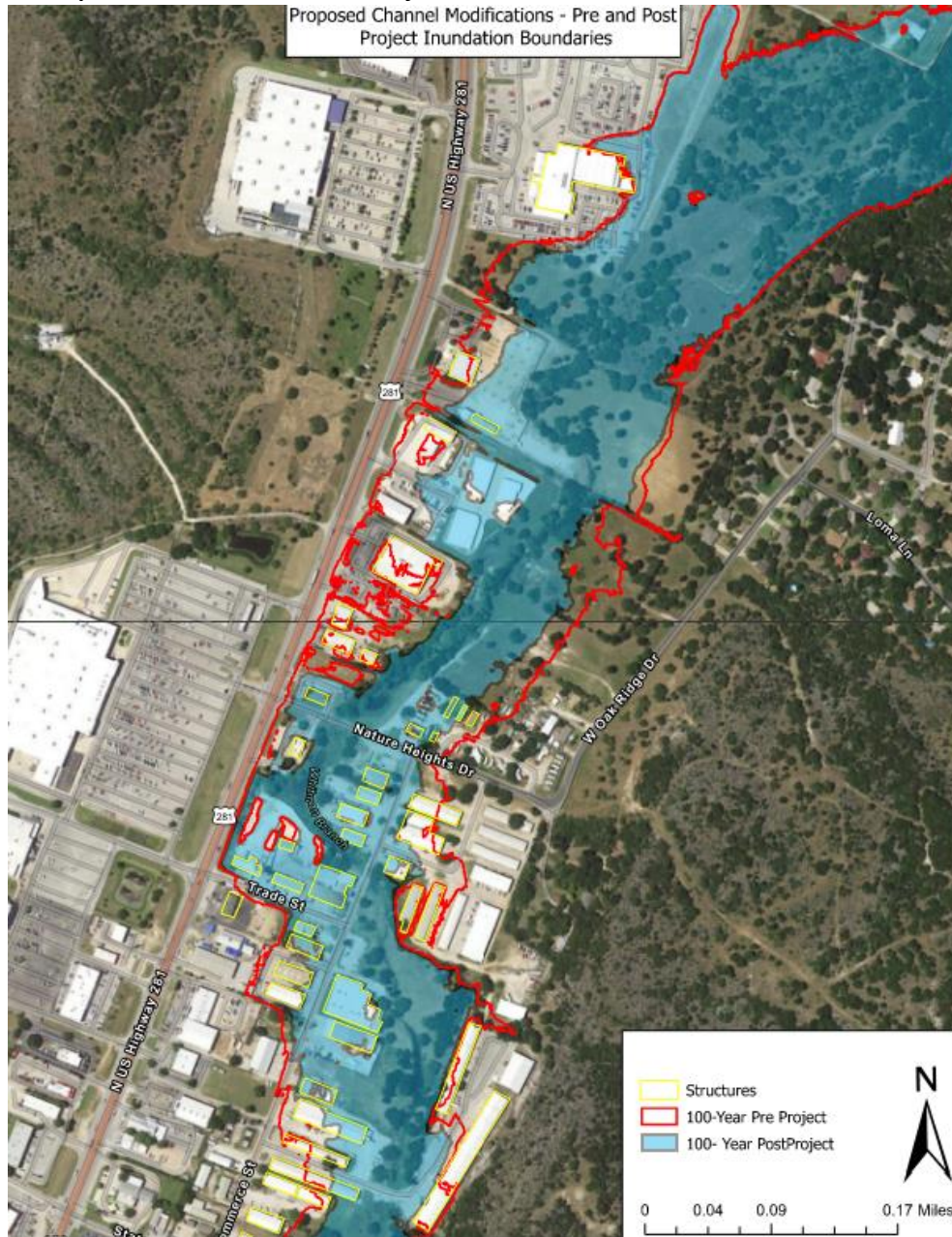
- Stormwater would not increase inundation in areas beyond the public right-of-way, project property, or easement.
- Stormwater would not increase inundation of storm drainage networks, channels, and roadways beyond design capacity.
- In no cases is there an increase of water surface elevation downstream of the proposed regional detention facility. Differences in water surface elevations round to 0.0 feet (< 0.05ft) measured along the hydraulic cross-section within the right-of-way.

As the projects are advanced, the impact analysis should be updated to reflect final design and confirm no negative impacts.

Alternative 2 – Channel Modifications

This FMP proposes a channelization solution to lower floodwaters within the flood prone Commerce Street area. The project would modify the existing natural channel into a trapezoidal engineered channel. Improvements would begin just upstream of US 281 and will end upstream of the Commerce Street industrial area near 3105 N. US 281. The project would flatten the longitudinal slope of the channel, deepening the channel through the Commerce Street area by up to 10 feet. Channel widening would vary depending on space availability and in locations would increase the bottom width from around 50 feet to over 200 feet. The channel is assumed to have earthen 4:1 side slopes except for select narrow areas in the heart of the Commerce Street area where limited sections are assumed to have vertical concrete retaining walls.

Figure 2-1: Proposed Improvements – Pre and Post Project Inundation Boundaries



Project Benefits

This channel modification concept would significantly lower flood elevations within Whitman Branch within the project area. Approximately 26 of 49 structures in the area would be removed from the floodplain while reducing depth of flood inundation for the remainder of the structures. Because of the nature of the conveyance improvements, the existing low water crossings at Commerce Street and Nature Heights Road would need to be replaced with bridge structures. New bridge crossings at Commerce Street and Nature Heights Street would still have some risk of overtopping in a 100-Year event but would not overtop in more frequent events.

Table 2-1: Risk Reduction Benefits

Flood Risk Condition	Number of At-Risk Buildings	Number of At-Risk Roadway Crossings (low water crossings)
Existing Condition 1% Annual Chance (100-year)	49	2 (less than 2-year level of service)
Post-Project Condition 1% Annual Chance (100-year)	23	2 (improved to 25 year level of service)

Estimate of Probable Cost

The proposed project total capital cost is estimated to be \$,79,600,000 in 2023 dollars. Adjusted for 2020 dollars the cost of the project would be approximately \$,69,500,000. Cost of the project include construction costs, land acquisition, design and permitting (20%), and contingency (35%).

Table 2-2: Cost Estimate

2023 Lower Colorado Regional Flood Plan: Project Cost Estimate							
Cost Verification Controls must be in place to assure that construction costs are reasonable and consistent with market costs at the time and place of construction.							
Applicant/Subrecipient:	City of Marble Falls						
Site/Activity Title:	Channel Improvements						
Consultant:	HDR Engineering, Inc. TBPE Registration No. F-754						
Date:	3/24/2023						
Eligible Activity:	Flood control and drainage improvements						
Materials/Facilities/Services	\$/Unit	Unit	Quantity	Construction	Acquisition	2023 Cost	2020 Cost (adjusted using ENR CCI)
Mobilization	11%	LS	1	\$ 2,085,105.00		\$ 2,085,105.00	\$ 1,819,853.34
Preparing the Right of Way	\$ 20,000.00	LS	1	\$ 20,000.00		\$ 20,000.00	\$ 17,455.75
Channel Excavation	\$ 55.00	CY	265000	\$ 14,575,000.00		\$ 14,575,000.00	\$ 12,720,876.16
Class C (Topsoil), Plan Quantity	\$ 30.00	CY	18500	\$ 555,000.00		\$ 555,000.00	\$ 484,397.00
Embankment	\$ 50.00	CY	1000	\$ 50,000.00		\$ 50,000.00	\$ 43,639.37
Concrete Structures	\$ 1,000.00	CY	550	\$ 550,000.00		\$ 550,000.00	\$ 480,033.06
Bridges	\$ 150.00	SF	12500	\$ 1,875,000.00		\$ 1,875,000.00	\$ 1,636,476.35
Concrete Riprap	\$ 500.00	CY	200.00	\$ 100,000.00		\$ 100,000.00	\$ 87,278.74
Soil Retention Blanket Class A; Type G	\$ 7.50	SY	110000	\$ 825,000.00		\$ 825,000.00	\$ 720,049.59
Rock Berm	\$ 31.50	LF	5000	\$ 157,500.00		\$ 157,500.00	\$ 137,464.01
Silt Fence for Erosion Control	\$ 6.00	LF	13000	\$ 78,000.00		\$ 78,000.00	\$ 68,077.42
Care of Surface Water	\$ 120,000.00	LS	1	\$ 120,000.00		\$ 120,000.00	\$ 104,734.49
Traffic Control	\$ 50,000.00	LS	1	\$ 50,000.00	\$ -	\$ 50,000.00	\$ 43,639.37
TOTAL CONSTRUCTION COST				\$ 18,955,500.00	\$ -	\$ 21,000,000.00	\$ 18,300,000.00
Design and Permitting (20% construction cost)	20%					\$ 4,200,000.00	\$ 3,665,707.02
Environmental; archaeological & historical resources	\$ 250,000.00	LS	1			\$ 250,000.00	\$ 218,196.85
CLOMR / LOMR Preparation	\$ 50,000.00	LS	1			\$ 50,000.00	\$ 43,639.37
Mitigation; utility relocation	\$ 20,000,000.00	LS				\$ 20,000,000.00	\$ 17,455,747.73
Interest during construction (*assume 1Yr)	3.5%					\$ 735,000.00	\$ 641,498.73
Inspection; pilot testing; warranty; manuals	\$ 5,000.00	LS	1			\$ 5,000.00	\$ 4,363.94
Contingency(s) (35% construction cost)	35%					\$ 7,350,000.00	\$ 6,414,987.29
Property Acquisition	\$10,000,000.00	LS	1			\$ 10,000,000.00	\$ 8,727,873.86
TOTAL ADDITIONAL COST						\$ 42,600,000.00	\$ 37,200,000.00
TOTAL COST						\$ 63,600,000.00	\$ 55,500,000.00
Value of Adversely Impacted Parcels	\$17,000,000	LS	1			\$ 17,000,000.00	\$ 14,837,385.57
TOTAL COST						\$ 79,600,000.00	\$ 69,500,000.00

Project Constraints

For acquisition estimates, a cost of 3 times the reported market value in the TWDB database is assumed.

- Nearly the entirety of FMP improvements would be located on private property.
 - The estimated value of property containing the improvements footprint is \$10,000,000. Partial buyout is assumed for properties not adversely affected hydraulically.

Permitting will be a major challenge for this project.

- This project would likely require an individual USACE Section 404 permit because of permanent impacts to jurisdictional waters of the U.S.
 - Mitigation costs for this Channel Improvements Alternative are estimated based on mitigation costs for the Regional Detention Alternative outlined in the Environmental Memorandum (Attachment 1). Because the proposed mitigation cost would be approximately \$1,000,000 for

each 300 linear feet, a total cost of \$20,000,000 is assumed for this project of approximately 6,000 linear feet.

- Local permitting would be required; this project is entirely within the City of Marble Falls.
- FEMA compliance and coordination is required for floodplain mapping and re-modeling.

Benefit Cost Analysis

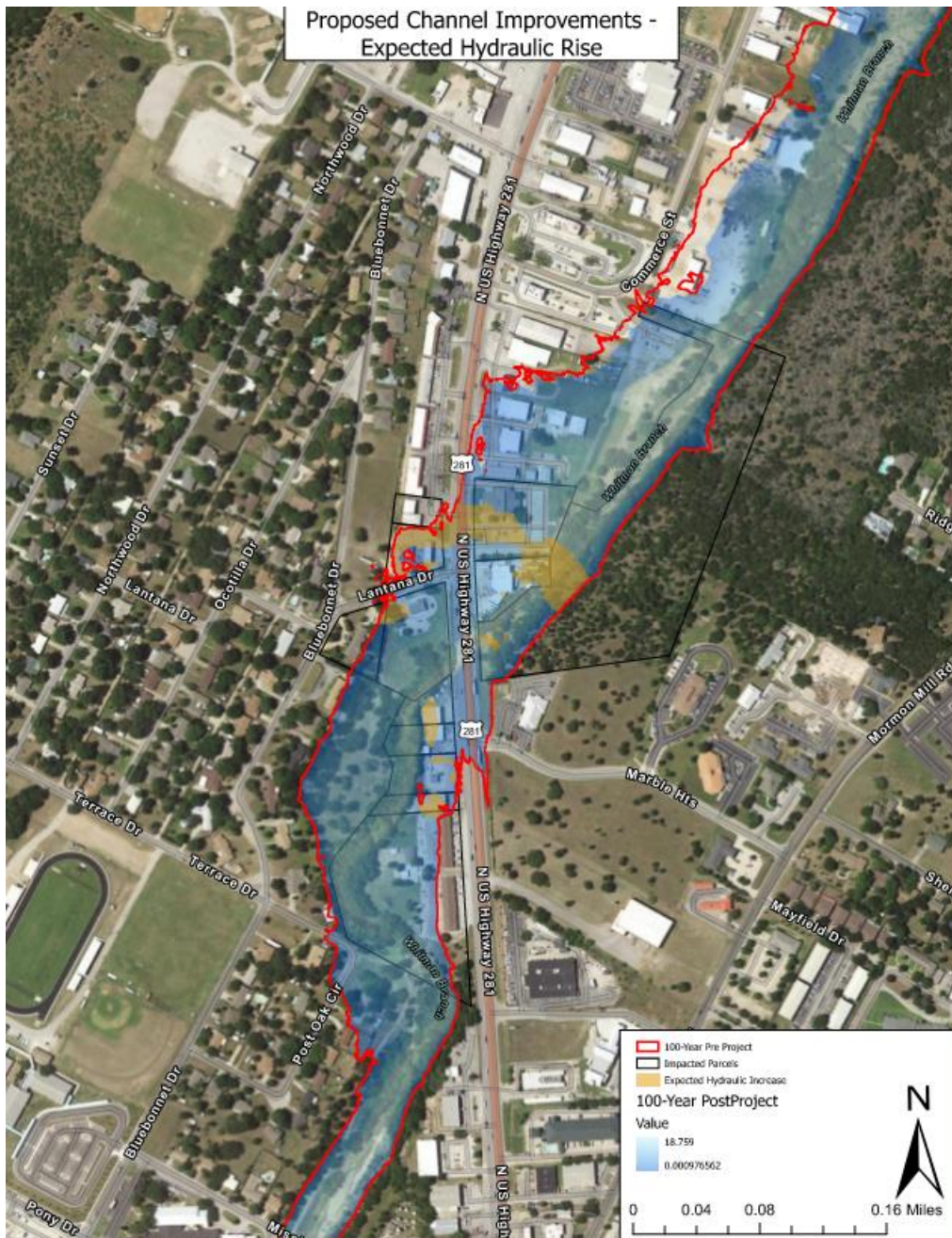
Table 2-3: Benefit Cost Analysis

Input Into BCA Toolkit		
Project Useful Life	30	
Event Damages	Baseline	Project
2 - year storm	\$1,151,205	\$0
10 - year storm	\$4,324,096	\$1,135,864
100 - year storm	\$13,739,117	\$4,271,931
Total Benefits from BCA Toolkit	\$18,397,223	
Other Benefits (Not Recreation)	\$2,895,337	
Recreation Benefits	-	
Total Costs	\$67,251,517	
Net Benefits	-\$45,958,957	
Net Benefits with Recreation	-\$45,958,957	
Final BCR	0.3	
Final BCR with Recreation	0.3	

No Negative Impact

- This project as it is proposed would have some effects hydraulically and hydrologically.
 - Hydraulic impacts could be offset with property buyouts. These value of hydraulically affected parcels is assumed to be \$17,000,000, the majority of which are expected to have increased structural flooding.
- Hydrologic impacts are minimal and are assumed to be within an acceptable range.

Figure 2-3: Expected Hydraulic Rise

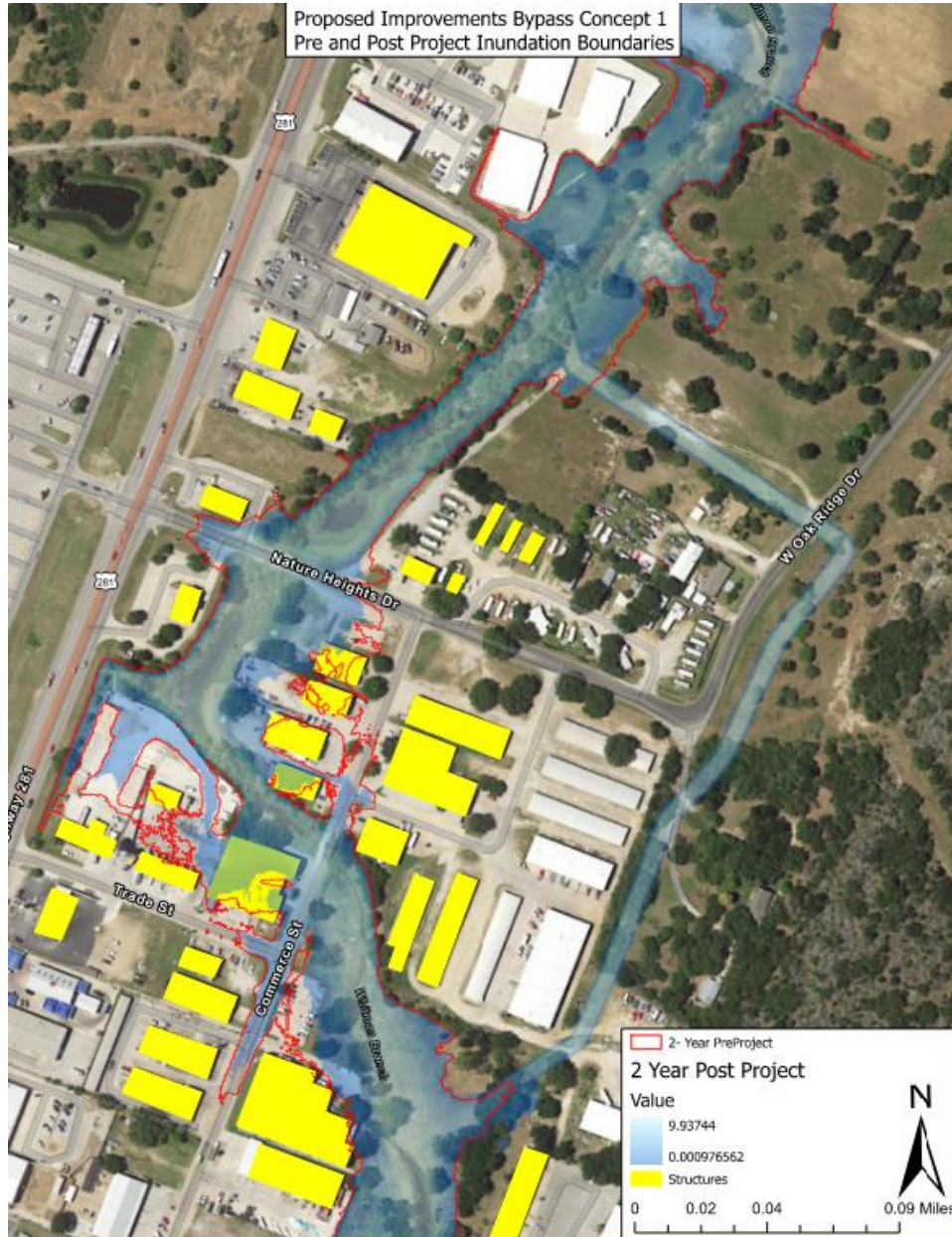


As the projects are advanced, the impact analysis should be updated to reflect final design and confirm no negative impacts.

Alternative 3 – Flood Bypass Concept 1

Flood Bypass Concept 1 proposes a hydraulic bypass that would reroute some flood waters around the Nature Heights Drive and Commerce Street low water crossings on Whitman Branch as conceptualized in the 2014 Flood Protection Planning Study. The proposed bypass concept would take flow from Whitman branch near 2904 Nature Heights Drive to Nature Heights Drive, then along Nature Heights drive in private property back to Whitman Branch near 2706 Commerce Street. This flood bypass would have the effect of reducing discharge and flood levels, to some extent, within the bypassed reach of Whitman Branch.

Figure 3-1: Proposed Improvements – Pre and Post Project Inundation Boundaries



Project Benefits

Between the upstream bypass location and the downstream re-entry of the bypass, the total peak flows in Whitman Branch are expected to be marginally reduced. This bypass project is expected to provide some limited flood risk reduction, particularly in lower frequency storm events where bypassed flow is a larger proportion of the total simulated flooding.

Table 3-1: Flow Reduction Benefits (measured upstream of proposed bypass)

Return event	Bypassed Flow (cfs)	Flow in Whitman Branch (cfs)	% Flow Bypassed (cfs)
2- Year	330	1220	21
10- Year	840	3550	19
25- Year	1020	5030	17
100- Year	1250	7150	15

This project would reduce flood depths but does not remove any structures from the 100-year floodplain and would have the net effect of adding 1 structure.

Table 3-2: Risk Reduction Benefits

Flood Risk Condition	Number of At-Risk Buildings	Number of At-Risk Roadway Crossings (low water crossings)
Existing Condition 1% Annual Chance (100-year)	49	3
Post-Project Condition 1% Annual Chance (100-year)	48	3

Estimate of Probable Cost

The proposed project total capital cost is estimated to be \$5,500,000 in 2023 dollars. Adjusted for 2020 dollars the cost of the project would be approximately \$4,600,000. The cost of the project includes construction costs, design and permitting (20%), and contingency (35%). Land acquisition costs for the flood bypass channel are estimated to be \$1,300,000. There are multiple parcels downstream of the proposed improvements that would have negative hydraulic impacts. If this project were to be coupled with the Regional Detention Alternative, no hydraulic impacts would be expected. If these additional parcels are required to be acquired because of hydraulic impacts, then the total expected land acquisition costs would increase by approximately \$28.7M and \$25M in 2023 and 2020 dollars, respectively. These costs, with and without impacted properties are subtotaled separately.

Table 3-3: Cost Estimate

2023 Lower Colorado Regional Flood Plan: Project Cost Estimate							
Cost Verification Controls must be in place to assure that construction costs are reasonable and consistent with market costs at the time and place of construction.							
Applicant/Subrecipient:	City of Marble Falls						
Site/Activity Title:	Bypass Improvements - A						
Consultant:	HDR Engineering, Inc. TBPE Registration No. F-754						
Date:	3/24/2023						
Eligible Activity:	Flood control and drainage improvements						
Materials/Facilities/Services	\$/Unit	Unit	Quantity	Construction	Acquisition	2023 Cost	2020 Cost (adjusted using ENR CCI)
Mobilization	11%	LS	1	\$ 262,505.83		\$ 262,505.83	\$ 229,111.78
Preparing the Right of Way	\$ 20,000.00	LS	1	\$ 20,000.00		\$ 20,000.00	\$ 17,455.75
Excavation	\$ 30.00	CY	60000	\$ 1,800,000.00		\$ 1,800,000.00	\$ 1,571,017.30
Channel Excavation	\$ 100.00	CY	700	\$ 70,000.00		\$ 70,000.00	\$ 61,095.12
Class C (Topsoil), Plan Quantity	\$ 30.00	CY	4389	\$ 131,666.67		\$ 131,666.67	\$ 114,917.01
Embankment	\$ 50.00	CY	500	\$ 25,000.00		\$ 25,000.00	\$ 21,819.68
Concrete Structures	\$ 1,000.00	CY	50	\$ 50,000.00		\$ 50,000.00	\$ 43,639.37
Concrete Riprap	\$ 500.00	CY	100.00	\$ 50,000.00		\$ 50,000.00	\$ 43,639.37
Soil Retention Blanket Class A; Type G	\$ 5.00	SY	30000	\$ 150,000.00		\$ 150,000.00	\$ 130,918.11
Rock Berm	\$ 31.50	LF	500	\$ 15,750.00		\$ 15,750.00	\$ 13,746.40
Silt Fence for Erosion Control	\$ 6.00	LF	4000	\$ 24,000.00		\$ 24,000.00	\$ 20,946.90
Traffic Control	\$ 50,000.00	LS	1	\$ 50,000.00	\$ -	\$ 50,000.00	\$ 43,639.37
TOTAL CONSTRUCTION COST				\$ 2,386,416.67	\$ -	\$ 2,600,000.00	\$ 2,300,000.00
Design and Permitting (20% construction cost)	20%					\$ 520,000.00	\$ 453,849.44
Environmental; archaeological & historical resources	\$ 25,000.00	LS	1			\$ 25,000.00	\$ 21,819.68
CLOMR / LOMR Preparation	\$ 60,000.00	LS	1			\$ 60,000.00	\$ 52,367.24
Interest during construction (*assume 1Yr)	3.5%					\$ 91,000.00	\$ 79,423.65
Inspection; pilot testing; warranty; manuals	\$ 5,000.00	LS	1			\$ 5,000.00	\$ 4,363.94
Contingency(s) (35% construction cost)	35%					\$ 910,000.00	\$ 794,236.52
Property Acquisition	\$1,300,000	LS	1			\$ 1,300,000.00	\$ 1,134,623.60
TOTAL ADDITIONAL COST						\$ 2,900,000.00	\$ 2,500,000.00
TOTAL COST						\$ 5,500,000.00	\$ 4,800,000.00
Value of Adversely Impacted Parcels	\$28,700,000	LS	1			\$ 28,700,000.00	\$ 25,048,997.99
TOTAL COST						\$ 34,200,000.00	\$ 29,800,000.00

Project Constraints

This proposed project would have many challenges in design and permitting phases. The value to acquire property is assumed as three times the reported market value of affected property value as reported in TWDB database.

- Nearly the entirety of proposed project improvements are located on private property. Multiple parcels would be affected, so property or easement acquisition would be a major component of the FMP.
 - The estimated value of property containing the flood bypass channel is \$1,300,000.
 - The downstream end of the project at Whitman Branch somewhat is hydraulically sensitive and the project may have the potential to marginally impact several properties in the floodplain. The value of these properties is estimated at \$28,700,000 to acquire.

Permitting would be less of a challenge for this project compared to the regional detention and channel modifications alternatives because there would be less impact to jurisdictional waters of the United States.

- This project may require a Nationwide USACE Section 404 permit if improvements are required to encroach into waters of the United States.
- Local permitting will be required; this project is believed to be entirely within the City of Marble Falls.
- FEMA compliance and coordination is required for floodplain mapping and re-modeling.

Benefit Cost Analysis

Table 3-4: Benefit Cost Analysis

Input Into BCA Toolkit		
Project Useful Life	30	
Event Damages	Baseline	Project
2 - year storm	\$704,806	\$574,723
10 - year storm	\$3,877,696	\$3,371,883
100 - year storm	\$13,345,785	\$12,346,437
Total Benefits from BCA Toolkit	\$2,337,727	
Other Benefits (Not Recreation)	\$3,217,041	
Recreation Benefits	-	
Total Costs	\$28,894,496	
Net Benefits	-	
Net Benefits with Recreation	\$23,339,728	
Final BCR	0.2	
Final BCR with Recreation	0.2	

No Negative Impact

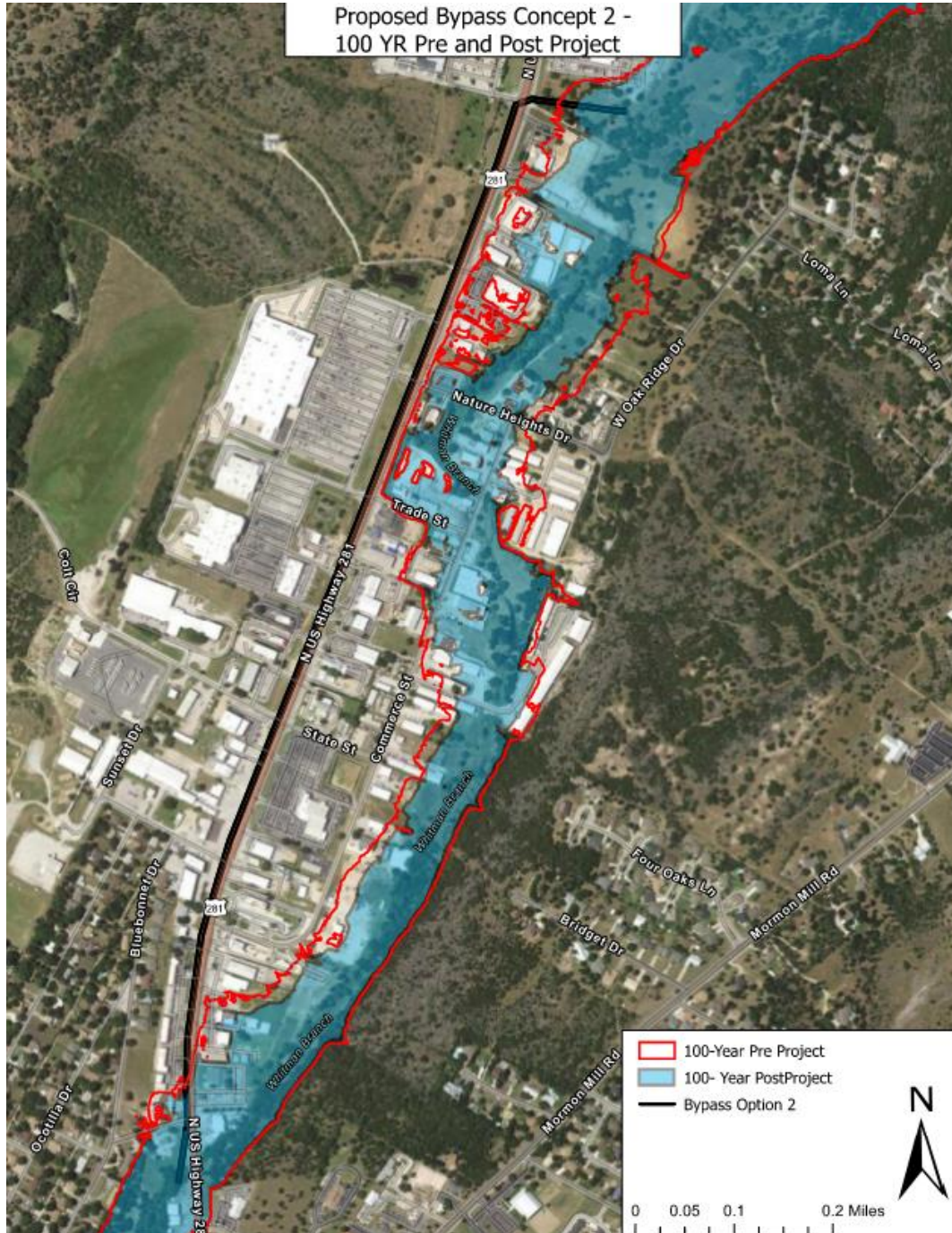
- This project as it is proposed as a standalone project would have some effects hydraulically and marginal effects hydrologically.

- Hydraulic impacts can be offset with property buyouts. These value of hydraulically affected parcels is assumed to be \$28,700,000, the majority of which are expected to have increased structural flooding. Hydraulic impact would also be offset by coupling this project with the Regional Detention Alternative. The expected project BCR if coupled with Regional Detention is 0.5.
- Hydrologic impacts are minimal and are assumed to be within an acceptable range.

Alternative 4 – Flood Bypass Concept 2

Flood Bypass Concept 2 proposes a longer hydraulic bypass that would reroute flood waters around the flood prone Commerce Street area of Whitman Branch. The proposed project would bypass runoff from Whitman Branch near 3105 North US 281 Drive, to near 1300 Lantana Drive. This bypass would have the effect of reducing discharge and flood levels within the bypassed reach of Whitman Branch to a greater extent than Flood Bypass Concept 1. The project proposes 2-16-foot circular conduits that would be constructed primarily within the US 281 right of way. The length of the proposed bypass is approximately 6,700 linear feet.

Figure 4-1: Proposed Improvements – Pre and Post Project Inundation Boundaries



Project Benefits

For the bypassed reach of Whitman Branch, the total expected peak flows in Whitman Branch are expected to be reduced. This bypass project would provide a significant degree of flood risk reduction, particularly in lower frequency storm events where bypassed flow is a larger proportion of the total simulated flood flows.

Table 4-1: Flow Reduction Benefits (measured upstream of proposed bypass)

Return event	Bypassed Flow (cfs)	Flow in Whitman Branch (cfs)	% Flow Bypassed (cfs)
2- Year	1200	370	76
10- Year	3090	1360	69
25- Year	3640	2500	59
100- Year	4230	4470	49

Approximately 20 of 49 structures in the area would be removed from the floodplain while reducing the flood risk for the remainder of the structures.

Table 4-2: Risk Reduction Benefits

Flood Risk Condition	Number of At-Risk Buildings	Number of At-Risk Roadway Crossings (low water crossings)
Existing Condition 1% Annual Chance (100-year)	49	3
Post-Project Condition 1% Annual Chance (100-year)	29	3

Estimate of Probable Cost

The proposed project total capital cost is estimated to be \$65,000,000 in 2023 dollars. Adjusted for 2020 dollars the cost of the project would be approximately \$57,000,000. Cost of the project include construction costs, land acquisition, design and permitting (20%), and contingency (35%).

Table 4-3: Cost Estimate

2023 Lower Colorado Regional Flood Plan: Project Cost Estimate							
Cost Verification Controls must be in place to assure that construction costs are reasonable and consistent with market costs at the time and place of construction.							
Applicant/Subrecipient:		City of Marble Falls					
Site/Activity Title:		Tunnel Bypass Improvements - D					
Consultant:		HDR Engineering, Inc. TBPE Registration No. F-754					
Date:		3/24/2023					
Eligible Activity:		Flood control and drainage improvements					
Materials/Facilities/Services	\$/Unit	Unit	Quantity	Construction	Acquisition	2023 Cost	2020 Cost (adjusted using ENR CCI)
Mobilization	11%	LS	1	\$ 4,000,673.31		\$ 4,000,673.31	\$ 3,491,737.21
Preparing the Right of Way	\$ 200,000.00	LS	1	\$ 200,000.00		\$ 200,000.00	\$ 174,557.48
Excavation	\$ 30.00	CY	12000	\$ 360,000.00		\$ 360,000.00	\$ 314,203.46
Channel Excavation	\$ 100.00	CY	700	\$ 70,000.00		\$ 70,000.00	\$ 61,095.12
Class C (Topsoil), Plan Quantity	\$ 30.00	CY	1852	\$ 55,555.56		\$ 55,555.56	\$ 48,488.19
Embankment	\$ 10.00	CY	1200	\$ 12,000.00		\$ 12,000.00	\$ 10,473.45
Concrete Structures	\$ 1,000.00	CY	371	\$ 371,111.11		\$ 371,111.11	\$ 323,901.10
Standard Pre-cast Manhole w/Pre-cast Base, 48" Dia.	\$ 20,000.00	EA	15	\$ 300,000.00		\$ 300,000.00	\$ 261,836.22
Trench Excavation Safety Protective Systems (all depths)	\$ 10.00	LF	6700	\$ 67,000.00		\$ 67,000.00	\$ 58,476.75
Pipe, 192" Dia. (all depths), including excavation and backfill	\$ 2,500.00	LF	13400	\$ 33,500,000.00		\$ 33,500,000.00	\$ 29,238,377.45
Concrete Riprap	\$ 500.00	CY	462.96	\$ 231,481.48		\$ 231,481.48	\$ 202,034.12
Soil Retention Blanket Class A; Type G	\$ 5.00	SY	1852	\$ 9,259.26		\$ 9,259.26	\$ 8,081.36
Rock Berm	\$ 31.50	LF	500	\$ 15,750.00		\$ 15,750.00	\$ 13,746.40
Silt Fence for Erosion Control	\$ 6.00	LF	9600	\$ 57,600.00		\$ 57,600.00	\$ 50,272.55
Care of Surface Water	\$ 120,000.00	LS	1	\$ 120,000.00		\$ 120,000.00	\$ 104,734.49
Traffic Control	\$ 1,000,000.00	LS	1	\$ 1,000,000.00	\$ -	\$ 1,000,000.00	\$ 872,787.39
TOTAL CONSTRUCTION COST				\$ 36,369,757.41	\$ -	\$ 40,000,000.00	\$ 34,911,495.46
Design and Permitting (20% construction cost)							
Design and Permitting (20% construction cost)	20%					\$ 8,000,000.00	\$ 6,982,299.09
Environmental; archaeological & historical resources	\$ 10,000.00	LS	1			\$ 10,000.00	\$ 8,727.87
CLOMR / LOMR Preparation	\$ 60,000.00	LS	1			\$ 60,000.00	\$ 52,367.24
Interest during construction (*assume 1Yr)	3.5%					\$ 1,400,000.00	\$ 1,221,902.34
Inspection; pilot testing; warranty; manuals	\$ 5,000.00	LS	1			\$ 5,000.00	\$ 4,363.94
Contingency(s) (35% construction cost)	35%					\$ 14,000,000.00	\$ 12,219,023.41
Property Acquisition	\$ 1,500,000	LS	1			\$ 1,500,000.00	\$ 1,309,181.08
TOTAL ADDITIONAL COST						\$ 25,000,000.00	\$ 21,819,684.66
TOTAL COST						\$ 65,000,000.00	\$ 56,731,180.12

Project Constraints

This proposed project would have many challenges in design and permitting phases. The value to acquire property is assumed as three times the reported market value of affected property value as reported in TWDB database.

- Nearly the entirety of proposed project improvements is located on private property. Multiple parcels would be affected, so property or easement acquisition will be a major component of the FMP.

Permitting would be less of a challenge for this project compared to the regional detention and channel modifications alternatives because there would be less impact to jurisdictional waters of the United States.

- This project may require a Nationwide USACE Section 404 permit if improvements are required to encroach into waters of the United States.
- Local permitting will be required; this project is believed to be entirely within the City of Marble Falls.
- FEMA compliance and coordination is required for floodplain mapping and re-modeling.

- The project will exist somewhat on multiple private properties. Property acquisition can be time consuming and expensive. Multiple properties are hydraulically impacted in this configuration as well and may have to be acquired, at least partially.
- The project is primarily within the US 281 right of way and will likely require advanced funding agreements and permitting by TxDOT.
- Local permitting will be required; portions of this project are within the City of Marble Falls.
- FEMA compliance and coordination is required for floodplain mapping and re-modeling.

Benefit Cost Analysis

Table 4-3: Benefit Cost Analysis

Input Into BCA Toolkit		
Project Useful Life	30	
Event Damages	Baseline	Project
2 - year storm	\$704,806	\$787,202
10 - year storm	\$3,877,696	\$1,728,901
100 - year storm	\$13,338,417	\$5,406,884
<hr/>		
Total Benefits from BCA Toolkit	\$7,995,406	
Other Benefits (Not Recreation)	\$160,852	
Recreation Benefits	-	
Total Costs	\$54,916,440	
Net Benefits	-\$46,760,182	
Net Benefits with Recreation	-\$46,760,182	
Final BCR	0.1	
Final BCR with Recreation	0.1	

No Negative Impact

This project is expected to have unacceptable hydraulic and hydrologic impacts.

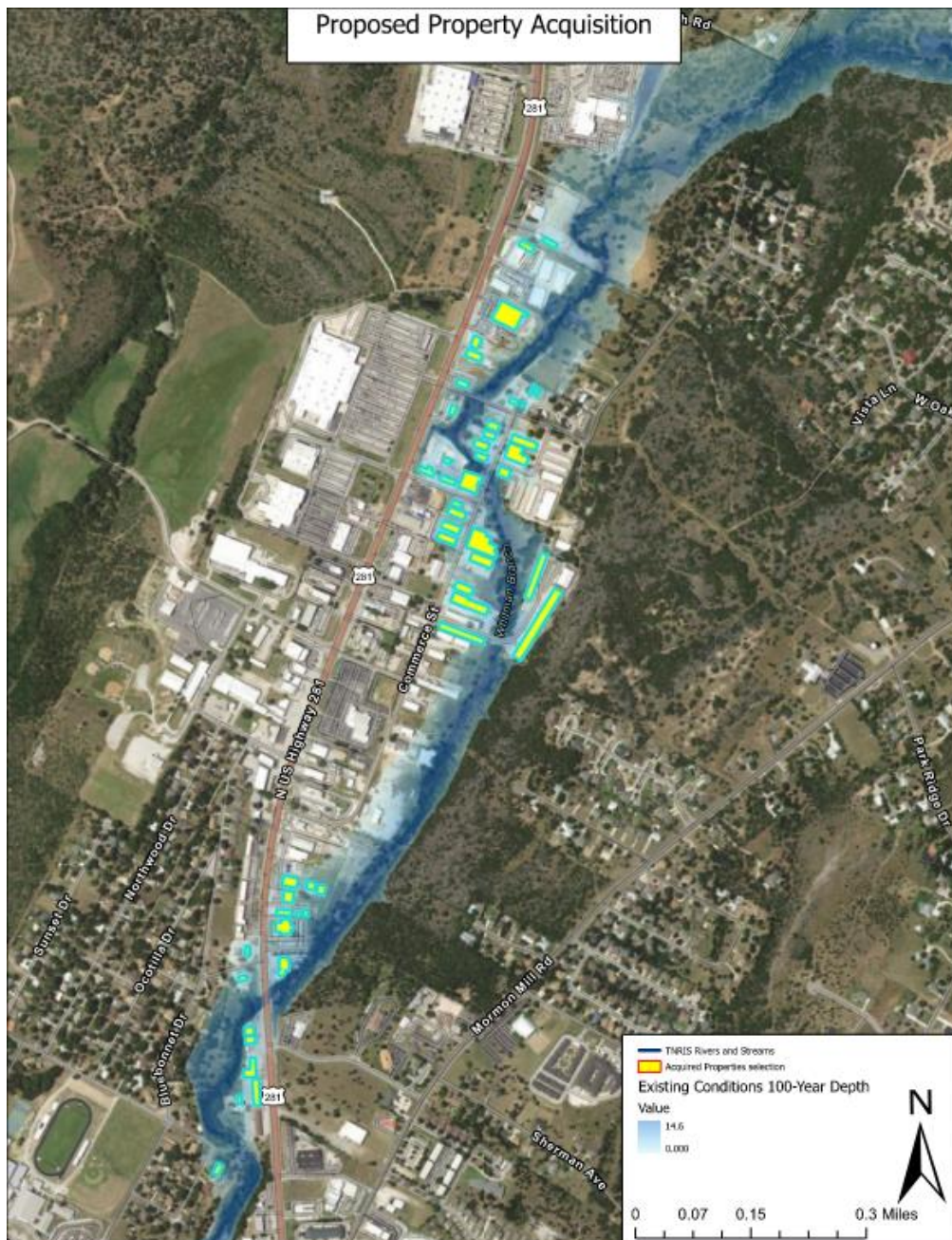
Alternative 5 – Property Buyouts

This alternative proposes a floodplain buyout program to acquire properties with expected structural flooding in the 100- Year flood event.

Project Benefits

Flood prone properties will no longer experience damage due to flooding if population is removed and existing improvements are removed, thereby eliminating all flood risk. The City of Marble Falls would purchase and own these flood prone properties and could convert them to park land or open green space.

Figure 5-1: Proposed Property Acquisition



Estimate of Probable Cost

The total buyout program is estimated to cost \$52,800,000 in 2023 dollars. Buyout costs are estimated as **3 times the market value** of the parcel in 2020.

Table 5-1: Proposed Property Acquisition Values / Cost Estimate

Parcel ID	TNRIS Parcels Value (2020)	Buyout Value	Structure Removal	Site Restoration
19550	\$ 239,948.00	\$ 719,844.00	\$50,000.00	\$5,000.00
19551	\$ 362,010.00	\$ 1,086,030.00	\$50,000.00	\$5,000.00
19552	\$ 169,500.00	\$ 508,500.00	\$50,000.00	\$5,000.00
19553	\$ 173,851.00	\$ 521,553.00	\$50,000.00	\$5,000.00
19584	\$ 89,640.00	\$ 268,920.00	\$50,000.00	\$5,000.00
19579	\$ 222,402.00	\$ 667,206.00	\$50,000.00	\$5,000.00
19580	\$ 199,651.00	\$ 598,953.00	\$50,000.00	\$5,000.00
55367	\$ 2,137,756.00	\$ 6,413,268.00	\$50,000.00	\$5,000.00
55372	\$ 1,819,590.00	\$ 5,458,770.00	\$50,000.00	\$5,000.00
20576	\$ 1,193,781.00	\$ 3,581,343.00	\$50,000.00	\$5,000.00
20574	\$ 187,085.00	\$ 561,255.00	\$50,000.00	\$5,000.00
57168	\$ 501,932.00	\$ 1,505,796.00	\$50,000.00	\$5,000.00
57277	\$ 448,433.00	\$ 1,345,299.00	\$50,000.00	\$5,000.00
57224	\$ 245,560.00	\$ 736,680.00	\$50,000.00	\$5,000.00
57276	\$ 189,426.00	\$ 568,278.00	\$50,000.00	\$5,000.00
57278	\$ 372,536.00	\$ 1,117,608.00	\$50,000.00	\$5,000.00
57223	\$ 1,086,754.00	\$ 3,260,262.00	\$50,000.00	\$5,000.00
33133	\$ 213,316.00	\$ 639,948.00	\$50,000.00	\$5,000.00
19586	\$ 1,538,936.00	\$ 4,616,808.00	\$50,000.00	\$5,000.00
19477	\$ 154,086.00	\$ 462,258.00	\$50,000.00	\$5,000.00
19484	\$ 143,334.00	\$ 430,002.00	\$50,000.00	\$5,000.00
19485	\$ 206,925.00	\$ 620,775.00	\$50,000.00	\$5,000.00
19473	\$ 767,790.00	\$ 2,303,370.00	\$50,000.00	\$5,000.00
19489	\$ 340,096.00	\$ 1,020,288.00	\$50,000.00	\$5,000.00
19472	\$ 570,955.00	\$ 1,712,865.00	\$50,000.00	\$5,000.00
19593	\$ 631,859.00	\$ 1,895,577.00	\$50,000.00	\$5,000.00
19598	\$ 258,525.00	\$ 775,575.00	\$50,000.00	\$5,000.00
115890	\$ 97,515.00	\$ 292,545.00	\$50,000.00	\$5,000.00
19594	\$ 216,412.00	\$ 649,236.00	\$50,000.00	\$5,000.00
19591	\$ 1,239,880.00	\$ 3,719,640.00	\$50,000.00	\$5,000.00
19480	\$ 308,265.00	\$ 924,795.00	\$50,000.00	\$5,000.00
19481	\$ 42,696.00	\$ 128,088.00	\$50,000.00	\$5,000.00
19480	\$ 308,265.00	\$ 924,795.00	\$50,000.00	\$5,000.00
19479	\$ 185,690.00	\$ 557,070.00	\$50,000.00	\$5,000.00
19483	\$ 101,592.00	\$ 304,776.00	\$50,000.00	\$5,000.00
SUM	\$ 16,965,992.00	\$ 50,897,976.00	\$ 1,750,000.00	\$ 175,000.00
		Total Buyout Alternative Cost		\$ 52,822,976.00

Project Constraints

A buyout program that would acquire these properties would take multiple years and would likely involve multiple phases. Initially buyouts could be done as a sale between willing parties and the City. More than likely, ultimate phases of buyouts would be forceful and would require use of eminent domain or a similar legal apparatus to acquire holdout properties.

A buyout program such as this one is extensive and would disaffect many businesses and residents. Many residents and businesses could be expected to relocate within the city, however, many could be expected to leave and not return. These buyouts could have long term to permanent damage to the city’s tax base and would likely face political and public opposition.

Benefit Cost Analysis

Table 5-2: Benefit Cost Analysis

Input Into BCA Toolkit		
Project Useful Life	30	
Event Damages	Baseline	Project
2 - year storm	\$704,806	\$0
10 - year storm	\$3,877,696	\$0
100 - year storm	\$13,345,785	\$0
Total Benefits from BCA Toolkit	\$17,632,478	
Other Benefits (Not Recreation)	\$5,664,456	
Recreation Benefits	-	
Total Costs	\$44,628,458	
Net Benefits	-\$21,331,524	
Net Benefits with Recreation	-\$21,331,524	
Final BCR	0.5	
Final BCR with Recreation	0.5	

No Negative Impact

Buying out flood prone properties in and of itself will have no effect on hydrology or hydraulics of Whitman Branch. Removal and clearing of bought out structures may have minor effects on overbank conveyance and storage of the creek, and would reduce the impervious cover in the basin. These minor effects of building removal have not been evaluated, but no adverse impacts are expected

Recommendation

Based on the findings of this alternatives analysis, Alternative 1, Regional Stormwater Detention is the most potentially feasible FMP to reduce flood risk to the chronic flood problems associated with floodwaters from Whitman Branch in or near the industrial area along Commerce Street between US 281 and the Nature Heights area. The City of Marble Falls is agreeable to sponsoring this FMP to be considered for future project funding through the TWDB. It is therefore recommended that Flood Management Evaluation No. 101000116 be reclassified as a Flood Mitigation Project.

The Regional Stormwater Detention alternative has the highest benefit-cost ratio of all alternatives evaluated at 1.3. This FMP is estimated to remove 38 out of 49 structures from the 100-year floodplain and greatly reduce flood risk at US 281 by eliminating flood overtopping for floods up to the 100-year event.

HDR has performed a preliminary desktop environmental and permitting constraints analyses in support of the recommended Regional Stormwater Detention alternative. These analyses are outlined in Attachment 1. There are anticipated permitting and environmental challenges and costs (include in the cost estimate) but nothing is currently identified that is prohibitive.

Alternatives 2, 3, 4, and 5 are not recommended as they all are more costly, provide less flood risk reduction benefits, and have lower benefit-cost ratios than the Regional Stormwater Detention alternative.

Technical Memorandum Attachments

Attachment 1

Environmental Memorandum

Memo

Date: April 7, 2023

Project: Marble Falls Potential Detention Pond Dam

To: Paul Shattuck, P.E. – HDR and Cris Parker, P.E. – HDR

From: James Thomas, SPWS; Ben Patterson; Kelsea Radican, HDR

Subject: Preliminary Environmental and Cultural Resources Evaluation for Potential Detention Pond, Marble Falls, TX

HDR Environmental and Cultural Resource professionals conducted a preliminary constraints evaluation of the proposed detention pond located on Whitman Branch north of Marble Falls. The study area consisted of the proposed location of a dam and the dry basin flood pool area of a detention pond being evaluated to provide flood risk reduction benefits in portions of Marble Falls along Whitman Branch. HDR evaluated potential for regulated water resources, cultural resources, and federally protected threatened or endangered species. The objective of this evaluation and memorandum is to provide an overview of potential constraints and preliminary cost considerations for regulatory permitting and mitigation for the project. This evaluation is a preliminary assessment and should be updated with on-site investigations if the project advances.

Clean Water Act

The study area includes two potential stream channels or tributaries to Whitman Branch, which have a confluence at the approximately location of the proposed earthen dam and culvert. The eastern tributary has a more distinct channel which appears to vary between 8- to 15-foot wide and is presumed to be intermittent based on aerial imagery. It includes two on-channel impoundments constructed for livestock use, and is anticipated to be a water of the U.S. under current and potential future definitions / guidance. It is worth noting the USACE and U.S. Environmental Protection Agency (EPA) have proposed new definitions to waters of the U.S. that could affect federal jurisdiction of ephemeral stream, and the U.S. Supreme Court is considering a case (*EPA v. Sackett*) that may result in additional regulatory guidance changes in 2023.

The western branch is less defined and appears to be ephemeral. There appears to be some segments with a well-defined scoured bed and other reaches which may be better described as vegetated swales. While it may not be considered a stream with a consistent ordinary high-water mark (OHWM), for the purposes of this preliminary evaluation it is considered a potential water of the U.S.



Exhibit 1. USGS topographic map of the proposed detention pond area with the blue outline depicting the approximate centerline of dam.

The construction of the dam is anticipated to require placement of fill within one or more stream channels likely to be considered waters of the U.S. Based on the preliminary location of the dam, there is the potential to impact approximately 600 linear feet (LF) of stream, or 300 LF of intermittent stream and 300 LF of ephemeral stream. The estimated acreage of impacts using an average OHWM width of 12 feet is approximately 0.165 acre. A Clean Water Act Section 404 permit would be required, and it is anticipated the project could meet the conditions of a Nationwide Permit (NWP) 43 for Stormwater Management Facilities, which allows permanent loss of up to 0.5 acre of non-tidal waters. However, NWP 43 does require pre-construction notification to the U.S. Army Corps of Engineers (USACE) and typically requires compensatory mitigation for permanent loss of stream of greater than 0.03 acre.

The site is located within the tertiary service area of the Cottonwood Creek Mitigation Bank located east of Pflugerville, Texas. While credit availability can fluctuate unpredictably, the bank currently has approximately 500 stream credits; however, with a tertiary service area multiplication factor of 3, there currently would not be enough credits to mitigate for all of the potential impacts to ephemeral and intermittent stream. The credit availability should continue to be monitored and pre-purchase of credits should be considered if available. However, for the purposes of this preliminary evaluation it is assumed that no mitigation credits are available or that permittee-responsible mitigation (PRM) in the project vicinity is determined to be ecologically preferable and most cost-effective mitigation alternative. The existing impoundments along the upstream segments of the Whitman Branch tributaries have modified

southwest of the site on the west side of US Highway 281. The PALM data indicates that the project area does contain moderate and high probability areas for buried archaeological deposits. Also, a review of aerial photography indicates a historic-aged homestead structure present within the proposed flood pool of the detention basin. The structure appears to be associated with early 20th Century ranching activities on the site, but more thorough investigations of the site and Burnet County archives will be needed to assess the potential eligibility for listing on the National Register of Historic Places (NRHP).

Endangered Species Act

HDR obtained a current Trust Resources List of threatened and endangered species list for the study area, from the U.S. Fish and Wildlife Service's (USFWS) Information for Planning and Consultation (IPaC) System (see **Attachment 1**). Federally listed threatened and endangered species that could potentially occur in the study area are listed in **Table 1**. A Trust Resources List is not an official list, which requires notification to USFWS. Once an official list is requested, additional species may be included for the area due to species status changes.

Table 1. Threatened and Endangered Species Potentially Occurring in the Study Area

Species Name	Status	Potential Habitat
Red knot (<i>Calidris canutus rufa</i>)	Threatened	NA
Piping plover (<i>Charadrius melodus</i>)	Threatened	NA
Monarch Butterfly (<i>Danaus plexippus</i>)	Candidate	Possible
Texas fatmucket (<i>Lampsilis bracteata</i>)	Proposed Endangered	Unlikely
Tricolored bat (<i>Perimyotis subflavus</i>)	Proposed Endangered	Yes
Golden-cheeked warbler (<i>Setophaga chrysoparia</i>)	Endangered	Yes
Bee Creek Cave Harvestman (<i>Texella reddelli</i>)	Endangered	Possible

The red knot (*Calidris canutus rufa*) and piping plover (*Charadrius melodus*) are federally-threatened shorebirds that have the potential to migrate through the study area. These species only require consideration for wind related projects within the migratory route (see **Attachment 1**). Therefore, the project would not be required to consult with USFWS for the red knot and piping plover.

The monarch butterfly (*Danaus plexippus*) is a candidate species and not yet proposed for listing. During the breeding season, monarchs lay their eggs on their obligate milkweed host plant (primarily *Asclepias* spp.), and larvae emerge after two to five days. In many regions where monarchs are present, monarchs breed year-round. Depending on the land use and habitat that occurs in the study area, monarch habitat may occur. However, the potential for the project to adversely impact this species is unlikely. It is expected that the monarch butterfly would become listed in 2024 and the status of this species should be closely monitored.

The Texas fatmucket (*Lampsilis bracteata*) is a freshwater mussel that has been proposed to list as endangered by the USFWS. Habitat includes small perennial streams to medium-sized rivers. The Texas fatmucket occurs in tributaries of the Colorado River drainage. Based on the aerial review, the two tributaries to Whitman Branch appear to be ephemeral or intermittent streams, and no other perennial water body appears in the study area. Therefore, it is unlikely that suitable habitat for the Texas fatmucket occurs in the study area.

The tricolored bat (*Perimyotis subflavus*), which occurs throughout much of the United States, east of the Rocky Mountains, is proposed to be listed as endangered by the USFWS. During the winter, tricolored bats hibernate in caves, abandoned mines, and other cave-like structures or even culverts in the southern United States where caves are sparse. During the spring, summer, and fall, tricolored bats are found in forested habitats where they roost in trees, primarily among leaves of live or recently dead deciduous hardwood trees, as well as in Spanish moss, clusters of pine needles, and occasionally built structures. Based on the preliminary desktop review, potential habitat for the tricolored bat does occur in the study area. It is expected that the final listing for the tricolored bat would become effective in 2024 and the status of this species should be closely monitored.

The golden-cheeked warbler (*Setophaga chrysoparia*) is an endangered neo-tropical songbird that nests in portions of the Texas hill country, including Burnet County. Typical nesting habitat is found in tall, dense, mature stands of Ashe juniper (*Juniperus ashei*) mixed with a variety of oaks (*Quercus* spp.) and other native trees and shrubs. Within a ten-mile radius of the study area, there have been five confirmed golden-cheeked warbler observations. The observation in closest proximity to the study area occurred in 1994 approximately 5.6 miles southeast of the study area. Based on the preliminary desktop review, potential habitat for the golden-cheeked warbler does occur in the study area.

The Bee Creek Cave harvestman (*Texella reddelli*) is a troglobitic harvestman listed as endangered by the USFWS. This species is endemic to a restricted range in the Balcones Canyonlands ecoregion of Texas, specifically portions of Burnet and Travis County. It is unlikely that karst features occur in the study area; however, the potential for karst features that provide habitat to the Bee Creek Cave harvestman cannot be discounted in the desktop review.

Preliminary Regulatory Cost Summary

Activity	Preliminary Estimate
On-site Natural & Cultural Resource Surveys	\$100,000 - \$200,000
Historic Structure Archival / NRHP-eligibility Evaluation	\$50,000 - \$75,000
Agency Consultation / Permitting (including USACE, THC, & USFWS informal consultation)	\$150,000 - \$250,000
CWA – Section 404 Mitigation planning / construction costs	\$250,000 - \$500,000
Section 106 – Site Testing / Mitigation	\$100,000 - \$500,000
Real Estate / Legal support for mitigation site protection	\$50,000 - \$150,000
Cumulative Total (range)	\$700,000 - \$1,675,000

Recommendations

If the detention pond is advanced as a potential flood risk reduction strategy for the Marble Falls area, it is recommended to perform onsite surveys to delineate potential waters of the U.S., evaluate protected species habitat occurrence, and identify potential cultural resources as soon as is practicable. This will allow input on the dam location and alignment to avoid and minimize impacts to protected state and federal resources to the extent practicable. Following those activities the evaluation of unavoidable impacts, initiation of the permitting process and more project-specific mitigation planning can commence.

Attachment I

USFWS Information for Planning and Consultation (IPaC) Database Report

IPaC resource list

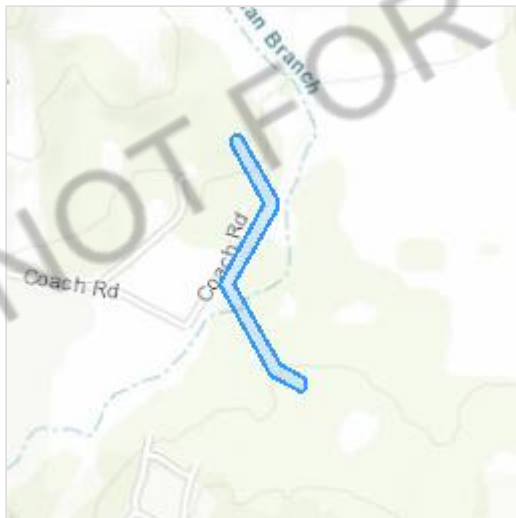
IPaC will be down for a maintenance event the week of April 10th. We apologize for any inconvenience this may cause. ×

This list includes trust resources (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Burnet County, Texas



Local office

Austin Ecological Services Field Office

☎ (512) 490-0057

📅 (512) 490-0974

10711 Burnet Road Suite 200

10711 East Hill Road, Suite 200
Austin, TX 78758-4460

NOT FOR CONSULTATION

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species¹ and their critical habitats are managed by the [Ecological Services Program](#) of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries²).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact [NOAA Fisheries](#) for [species under their jurisdiction](#).

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1. Species listed under the [Endangered Species Act](#) are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the [listing status page](#) for more information. IPaC only shows species that are regulated by USFWS (see FAQ).

2. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
<p>Tricolored Bat <i>Perimyotis subflavus</i> Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/10515</p>	Proposed Endangered

Birds

NAME	STATUS
<p>Golden-cheeked Warbler <i>Setophaga chrysoparia</i> Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/33</p>	Endangered
<p>Piping Plover <i>Charadrius melodus</i> This species only needs to be considered if the following condition applies: <ul style="list-style-type: none"> Wind Energy Projects There is final critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/6039</p>	Threatened
<p>Red Knot <i>Calidris canutus rufa</i> Wherever found This species only needs to be considered if the following condition applies: <ul style="list-style-type: none"> Wind Energy Projects There is proposed critical habitat for this species. https://ecos.fws.gov/ecp/species/1864</p>	Threatened

Clams

NAME	STATUS
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Texas Fatmucket *Lampsilis bracteata*

Proposed Endangered

Wherever found

There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat.

<https://ecos.fws.gov/ecp/species/9041>

Insects

NAME

STATUS

Monarch Butterfly *Danaus plexippus*

Candidate

Wherever found

No critical habitat has been designated for this species.

<https://ecos.fws.gov/ecp/species/9743>

Arachnids

NAME

STATUS

Bee Creek Cave Harvestman *Texella reddelli*

Endangered

Wherever found

No critical habitat has been designated for this species.

<https://ecos.fws.gov/ecp/species/2464>

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act¹ and the Bald and Golden Eagle Protection Act².

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described [below](#).

1. The [Migratory Birds Treaty Act](#) of 1918.
2. The [Bald and Golden Eagle Protection Act](#) of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern <https://www.fws.gov/program/migratory-birds/species>
- Measures for avoiding and minimizing impacts to birds
<https://www.fws.gov/library/collections/avoiding-and-minimizing-incident-take-migratory-birds>
- Nationwide conservation measures for birds
<https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf>

The birds listed below are birds of particular concern either because they occur on the [USFWS Birds of Conservation Concern \(BCC\)](#) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ [below](#). This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the [E-bird data mapping tool](#) (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found [below](#).

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle <i>Haliaeetus leucocephalus</i> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Oct 15 to Jul 31
Black-capped Vireo <i>Vireo atricapilla</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5716	Breeds Apr 1 to Sep 15
Chimney Swift <i>Chaetura pelagica</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 15 to Aug 25

Eastern Meadowlark <i>Sturnella magna</i> This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Apr 25 to Aug 31
Field Sparrow <i>Spizella pusilla</i> This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 1 to Aug 15
Lesser Yellowlegs <i>Tringa flavipes</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Painted Bunting <i>Passerina ciris</i> This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Apr 25 to Aug 15

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence

at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is $0.25/0.25 = 1$; at week 20 it is $0.05/0.25 = 0.2$.

- The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

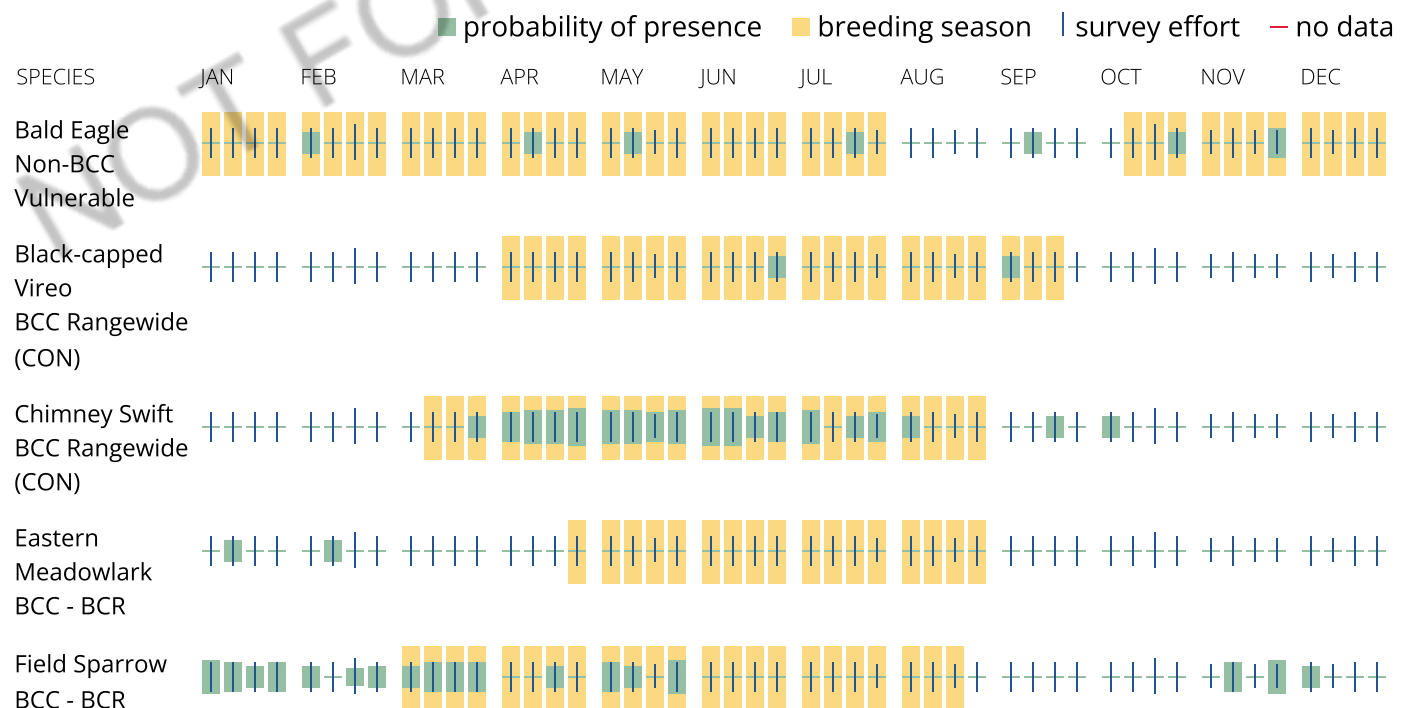
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

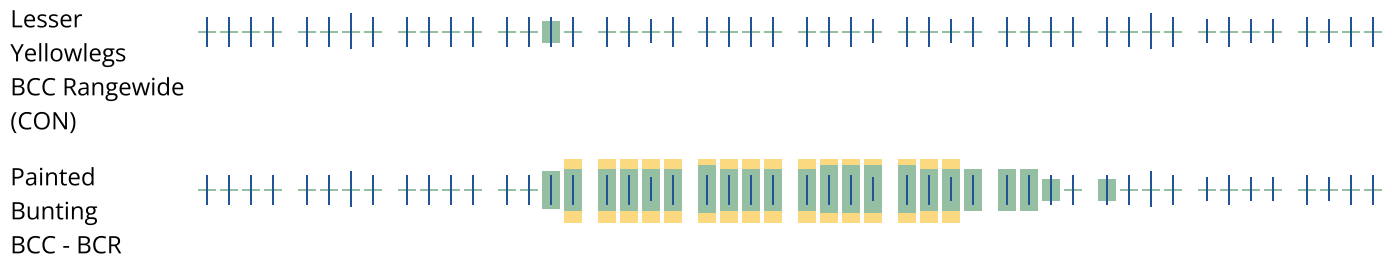
No Data (-)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.





Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

[Nationwide Conservation Measures](#) describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. [Additional measures](#) or [permits](#) may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS [Birds of Conservation Concern \(BCC\)](#) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the [Avian Knowledge Network \(AKN\)](#). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets](#) and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act](#) requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the [Rapid Avian Information Locator \(RAIL\) Tool](#).

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the [Avian Knowledge Network \(AKN\)](#). This data is derived from a growing collection of [survey, banding, and citizen science datasets](#).

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the [RAIL Tool](#) and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are [Birds of Conservation Concern](#) (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the [Eagle Act](#) requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the [Northeast Ocean Data Portal](#). The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the [NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf](#) project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the [Diving Bird Study](#) and the [nanotag studies](#) or contact [Caleb Spiegel](#) or [Pam Loring](#).

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to [obtain a permit](#) to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability

of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the [National Wildlife Refuge](#) system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to [NWI wetlands](#) and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local [U.S. Army Corps of Engineers District](#).

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER FORESTED/SHRUB WETLAND

[PFO1A](#)

RIVERINE

[R4SBC](#)

A full description for each wetland code can be found at the [National Wetlands Inventory website](#)

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tubercid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or

products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

NOT FOR CONSULTATION