Integrated Planning and Design Analysis and Environmental Assessment
Waco Metropolitan Area Regional Sewerage System Treatment Plant
Waco and McLennan County, Texas
Brazos River
Section 14 Emergency Streambank and Shoreline Protection

Prepared for

City of Waco, Texas

by

US Army Corps of Engineers
Fort Worth District

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1 Integrated EA and Planning Design Report

This integrated document contains information relevant to both an environmental assessment to satisfy the National Environmental Policy Act (NEPA) and a Planning and Design Analysis used as a planning document by the U.S. Army Corps of Engineers (USACE).

1.1 Study Authority

This study is conducted under the authority of the USACE Continuing Authorities Program, Section 14 of the Flood Control Act of 1946, as amended, which provides authority for the USACE to provide emergency streambank protection for public facilities and services.

1.2 Study Area

The study area is located along the Brazos River southeast of the city center of Waco, Texas. The Brazos River is a winding river that bends as it travels through the area. At one of the bends is the Waco Metropolitan Area Regional Sewerage System (WMARSS) Treatment Plant. Figure 1 shows the location of the study area.

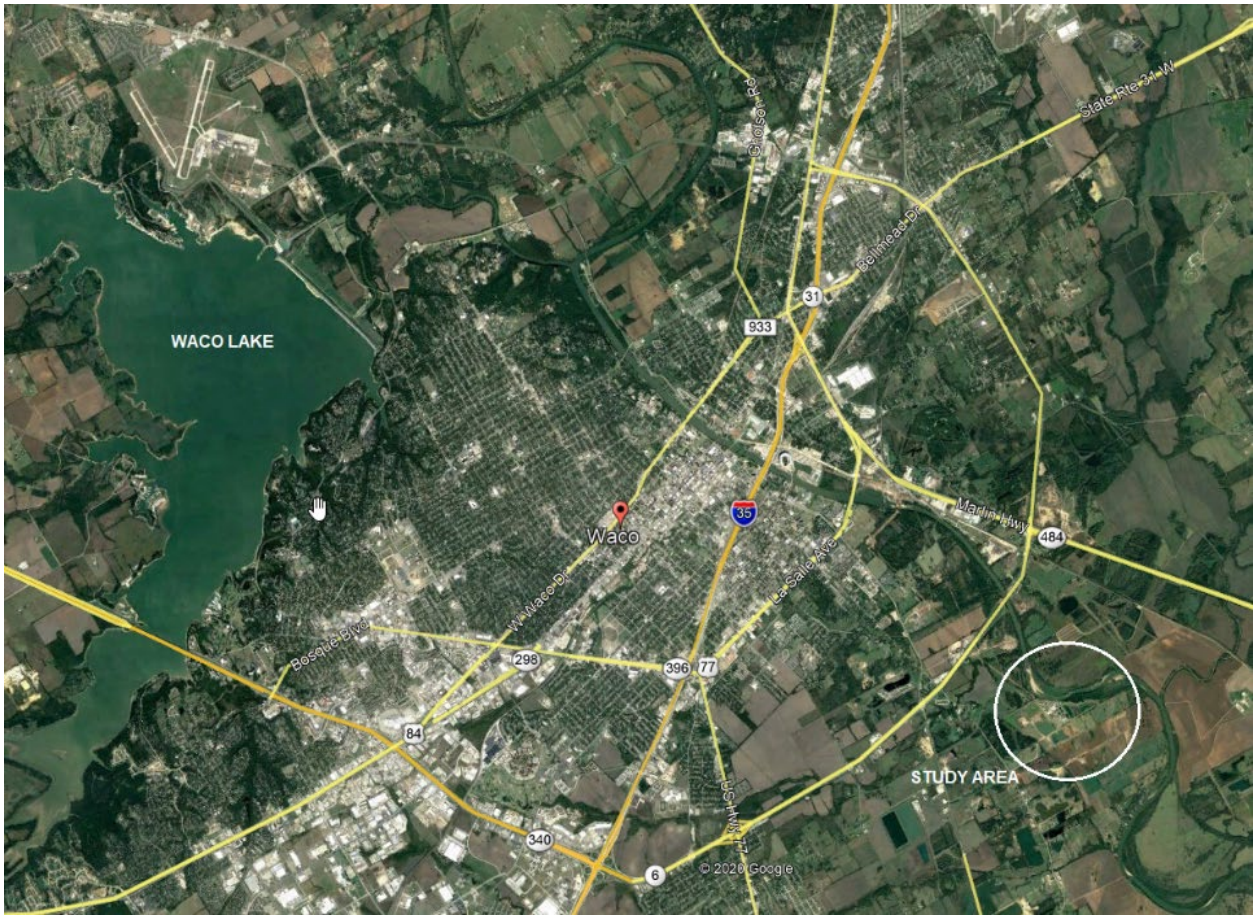

Figure 1. Study Area Map

1.3 Purpose and Need

The WMARSS Treatment Plant services both the cities of Waco and Robinson. It is located on the right

overbank of the Brazos River. Erosion has been encroaching on the plant over the last ten years due to high flows in the river from various storm events within the watershed causing an approximate erosion rate of seven feet per year. In the last flood event in 2016, the City of Waco reported a loss of 50 feet of bank. ONCOR relocated four power poles as the erosion caused power poles, guy wire anchors, and security fencing to fall into the river. Currently only 100 feet of bank remains until the WMARSS Treatment Plant access road is damaged and only 200 feet until the plant holding tanks are damaged. A chronological display of the erosion from 1995 – 2019 is shown in Figure 2. Added to each of the figures is a line representing the bank as it was 1995. Clear eveidence of erosion can be seen especially west of the existing USACE Section 14 Civil Works project.

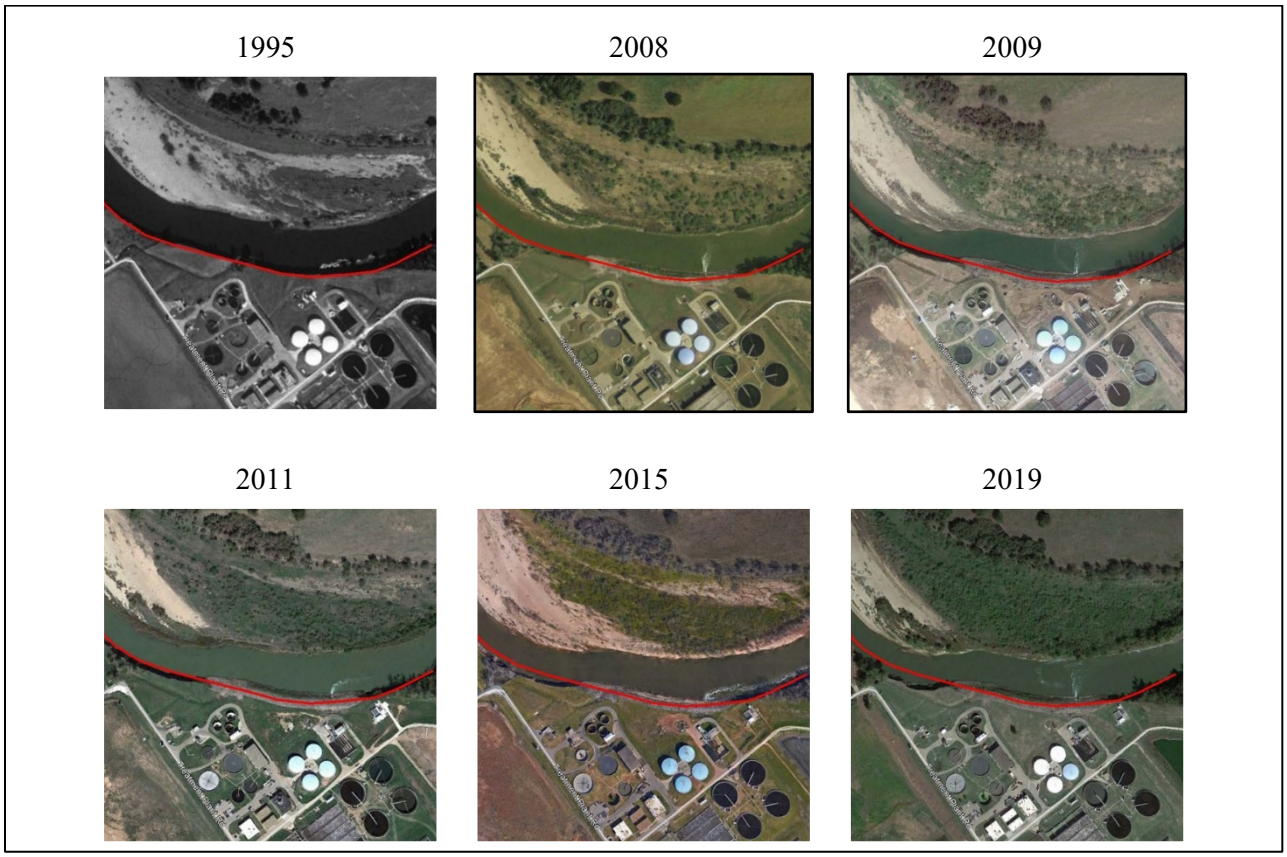

Figure 2. Study Area Erosion 1995 - 2019

2 Problem Identification

The right bank of the Brazos River, adjacent to the WMARSS Treatment Plant, has been steadily eroding during the past several years. The erosion, if allowed to continue, will impact three critical infrastructure facilities: WMARSS Treatment Plant, City of Robinson water intake (located about 1,000 feet upstream), and the Sandy Creek Pump Station intake structure (located within the WMARSS Treatment Plant facility). A ground view of the erosion is shown in Figure 3.

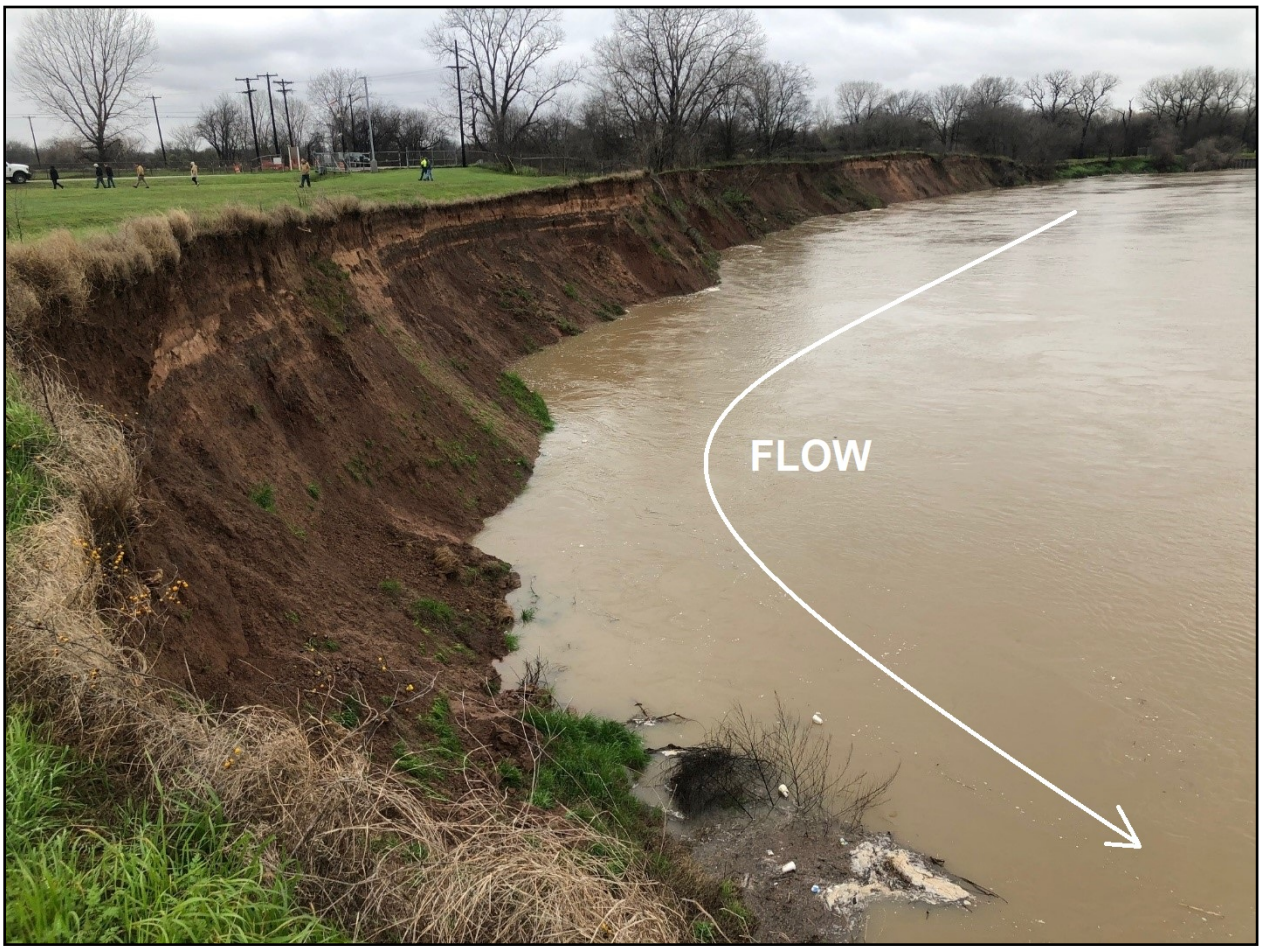

Figure 3. Study Area Erosion (February 2020)

2.1 Affected Facility and Infrastructure

There is an existing USACE Section 14 Civil Works project located at the WMARSS Treatment Plant consisting of about 900-feet of streambank protection (24-inches of stone riprap over nine inches of bedding) completed in 2002. Figure 4 to Figure 6 show the existing project. The 2002 project protects not only the treatment plant itself but also the riverbank upstream and downstream from the 72-inch outfall pipe from the treatment plant (O&M Manual, p. 5). As part of this report, the PDT identified where erosion has been encroaching on the plant over the last ten years due to high flows in the river from various storm events. Included in the facilities threatened by continued erosion that lie outside the existing 900-feet of riprap is the Sandy Creek pump station and the City of Robinson's intake structure. The City of Waco has also identified a number of facilities in the vicinity of the City of Robinson's intake structure lines that feed the plant. These are all shown in Figure 1. Those critical facilities outside the existing USACE Section 14 Civil Works project that were constructed prior to 2002 are as follows:

1) City of Waco 39-inch sanitary sewer line (39" SS) – 1989
2) City of Waco 30-inch sanitary sewer line (30" SS) – 1970
3) City of Waco 54-inch sanitary sewer line force main (54" SS FM) – 1981
4) City of Waco 8-inch sanitary sewer line force main (8" SS FM) – was constructed in 2002 into 2003.
5) ONCOR Power line – (POWER LINE) unknown, but prior to 2002.
6) City of Robinson water intake and water line – 1993.

The current Section 14 study is the continued erosion around treatment plant outside the existing project that has produced an approximate erosion rate of seven feet per year. A flood event in 2016 netted a loss of 50-feet of bank and the power company had to replace four power poles after losing them into the river. While the existing project continues to perform well, erosion will continue outside the bounds of the existing project. the facilities mentioned above are depicted in Figure 7.

Figure 4. Existing Streambank Protection Project

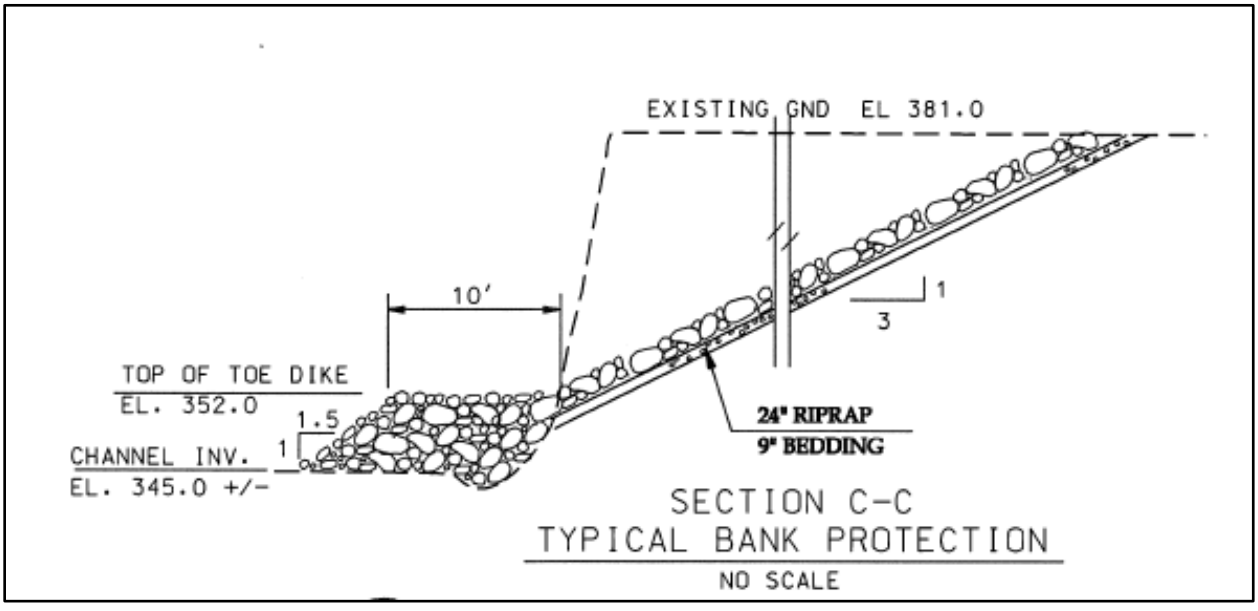

Figure 5. Existing Streambank Protection Project Typical Cross-Section

Figure 6. Existing Streambank Protection Project

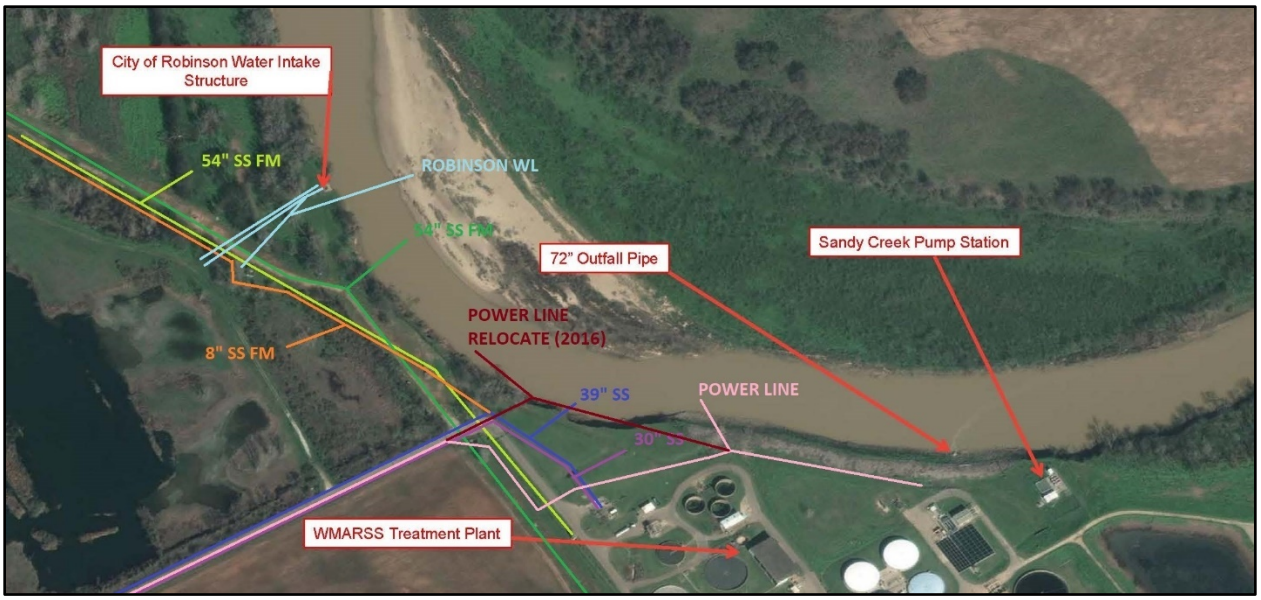

Figure 7. Protected and Unprotected Facilities

2.2 Most Probable Future Without Project

Riverbank erosion is expected to continue and degrade habitat and water quality. It is expected that within less than two years erosion will damage the WMARSS Treatment Plant access road and within less than ten years the WMARSS Treatment Plant facilities will be damaged, jeopardizing the plant's function. This is the Future without Project Condition or No Action Alternative (NAA).

3 Study Purpose

The goal of this study is to provide emergency streambank protection at the WMARSS Treatment Plant in Waco, Texas.

3.1 Planning Objectives

Planning objectives reflect an expression of public and professional issues or concerns about the use of water and related land resources resulting from the analysis of existing and future conditions in the study area. These planning objectives were used in guiding the development of alternative plans and their evaluation for the period of analysis.

1. Reduce the risk of erosion overtaking the WMARSS Treatment Plant to avoid or minimize the cost associated with the facility not operating as designed due to nearby streambank erosion
2. Provide an economically efficient solution
3. Minimize environmental and cultural resource impacts

3.2 Planning Constraints

Constraints are restrictions that limit the planning process and they include legal and policy constraints that apply to every Corps study and study-specific constraints that may only apply to this study.

While the top of bank in the study area is unstable and would be at high-risk, measures can be put in place to

minimize any potential risk of collapse during construction. As such, no conditions exist that would constrain any potential alternatives.

4 Existing Conditions

The following section describes the existing conditions of the study area. This analysis established a baseline, or existing condition, to provide a frame of reference to evaluate the performance of alternative plans.

4.1 Brazos River Conditions

The Brazos River in the study area is undergoing aggradation and degradation which are the fluvial processes mostly associated with a river and its differentiating parameters. Aggradation and degradation are generally influenced by river discharge, sediment load, morphological characteristics of river channel, and human interventions. If river water is unable to transfer bed load (particles that spend most of the time on the bottom) or channel material, then it is deposited within the channel resulting in the channel height increasing, i.e. aggradation. This changes the river morphology and hydraulic geometry. Degradation is the process responsible for lowering the riverbed and shifting the banks of the river channel.

Meandering river channels are asymmetrical with the deepest part being on the outside of each bend. Water flows faster in these deeper sections eroding material from the riverbank. Flows are slower in shallower areas near the inside of each bend. Slower water does not carry as much sediment and therefore deposits its load on a series of point bars.

- As a river goes around a bend, most of the water is pushed towards the outside causing increased speed and increased erosion due to hydraulic action and abrasion.
- Water on the inner bend is slower, causing the water to slow down and deposit the eroded material, creating a gentle slope of sand and shingle.

The Brazos River flows in a straight alignment 0.75 miles from the upstream SH 6 bridge before bending as it approaches the WMARSS Treatment Plant. Most of the erosion occurs at this bend (approximate radius of 1,000 feet). The erosion adjacent to the plant is occurring at the outside bend of the river with sediment deposition occurring on the opposite inside bend. River flow is directed towards the outer bank and eroding over time. Figure 8 shows the Brazos River alignment in the study area.

4.2 Water Resources

Water resources include both surface water and groundwater resources, associated water quality, and floodplains. Surface water includes all lakes, ponds, rivers, streams, impoundments, wetlands and estuaries within the watershed. Subsurface water, commonly referred to as ground water, is typically found in certain areas known as aquifers. Aquifers are areas with high porosity rock where water can be stored within pore spaces. Water quality describes the chemical and physical composition of water affected by natural conditions and human activities.

4.2.1 *Hydrology and Hydraulics*

Three USACE lakes are located upstream of the study area (Aquilla Lake, Waco Lake, and Whitney Lake). The total drainage area above Aquilla Dam is 255 square miles while the drainage area of the Aquilla Creek

watershed downstream of Aquilla Dam is 152.3 square miles. Waco Dam regulates discharges on the Bosque River with the total drainage area above Waco Dam being 1,652 square miles and the drainage area of the Bosque River watershed being 6.9 square miles. Whitney Dam regulates discharges on the Brazos River with the uncontrolled area above the Brazos River at the Brazos River at Waco Gage (SH 6) being 463 square miles. The regulation plan for these three projects allows for a combined flow at the Brazos River at Waco gage of 60,000 cfs. Pertinent data for the USGS stream gage located at SH 6 0.75 miles upstream of the WMARSS Central Wastewater Treatment Plant is as follows:

USGS 08096500 Brazos River at Waco, Texas
Gage datum 349.34 feet above NGVD29

The largest flows recorded at the Brazos River at Waco gage since 1990 are listed in Table 1.

Table 1. Largest Recorded Flow at Brazos River at Waco Gage Since 1990

Date	Peak Gage Height (ft)	Peak Flow (cfs)
10-May-90	24.35	40,800
21-Dec-91	26.5	50,000
30-Mar-07	26.46	39,900
27-Jun-15	22.48	30,800
13-Jun-16	23.54	33,200

The USACE - Fort Worth District developed new hydrologic and hydraulic models for the Waco and McLennan County area downstream of the three USACE lakes in March 2019. The study results for the 2-, 5-, 10-, 25-, 50-, 100-, 250-, and 500-year peak Brazos River flows, at the study area location, for the uncontrolled drainage area downstream of Whitney Dam, Aquilla Dam, and Waco Dam, are presented in Table 2.

Table 2. Brazos River Peak Flows at the Study Area

2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	250-Year	500-Year
(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
21,400	34,500	43,400	59,700	75,700	99,400	126,000	200,000

4.2.2 *Floodplains*

Federal Emergency Management Agency (FEMA) National Flood Insurance Maps were used to delineate the 100-year floodplains for the study area (FEMA, 2019). Additional Hydrology and Hydraulic models further refined the areas inundated at various annual chance exceedances (ACEs), including the 0.01 ACE. The FEMA Flood Maps delineate the watershed using different zone designations associated with the probability of flooding frequency for that area. The study area contains six different zone designations:

- A and AE – Areas subject to inundation by the one percent ACE,
- AO – Areas subject to inundation by the one percent ACE shallow flooding, usually sheet flow on sloping terrain) where average depths are between one and three feet,
- AH – Areas subject to inundation by the one percent ACE shallow flooding, usually areas of ponding) where average depths are between one and three feet,

- VE – Areas subject to inundation by the one percent ACE with additional hazards due to storm-induced velocity wave action
- X – Areas outside of the 0.2 percent floodplain
- NP – Areas not mapped by the FEMA National Flood Insurance Program.

FEMA has designated the areas adjacent to and surrounding the project area as Zone A. This is shown in Figure 8.

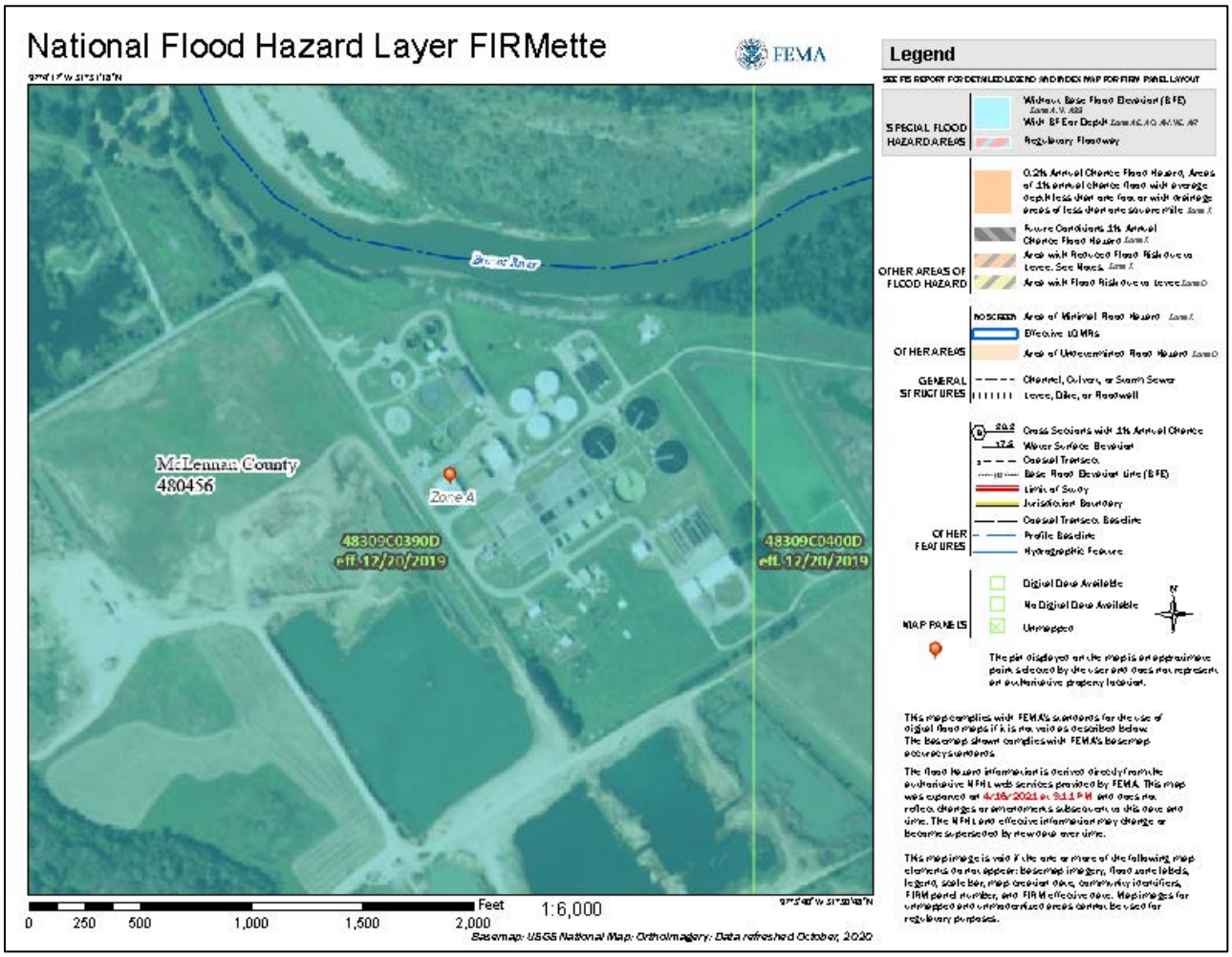

Figure 8. FEMA Flood Zone

Figure 9. Brazos River Alignment in the Study Area

4.2.3 *Precipitation*

The maximum annual precipitation at Waco, from the Waco Regional Airport, is 59.48 inches, occurring in 2004. The minimum annual precipitation was 14.92 inches occurring in 1954. The average annual precipitation is 34.7 inches. Waco and McLennan County are in a region that is subject to extreme variations in precipitation including drought conditions and extreme flooding conditions. The annual precipitation of the Waco area from 1960 to 2018 is presented in Figure 9.

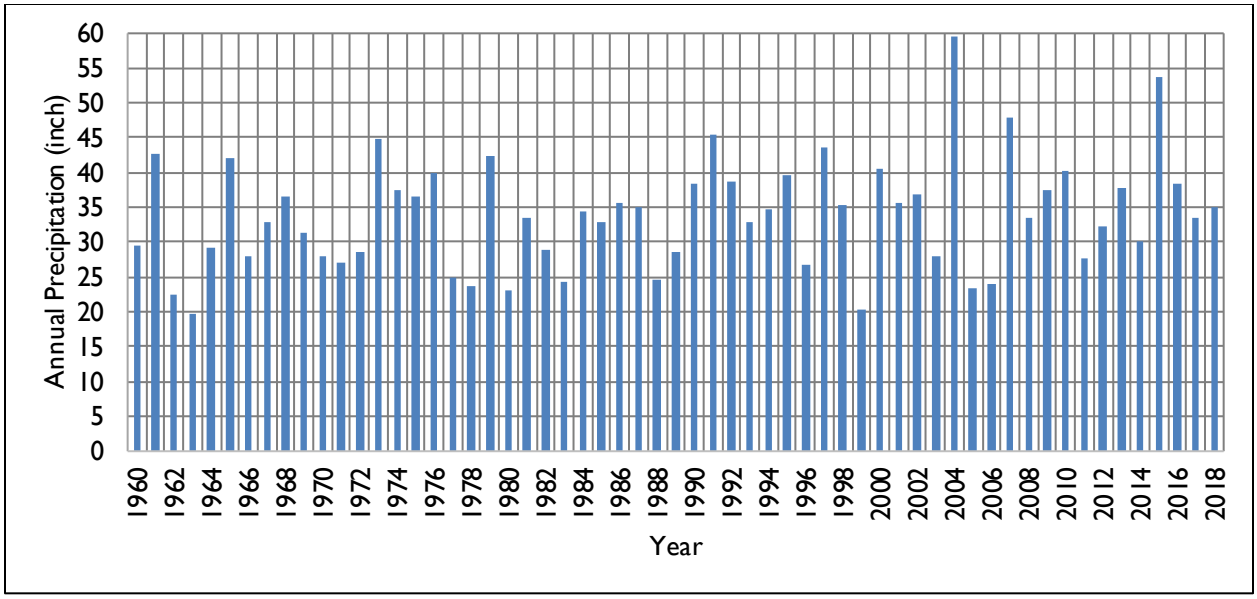

Figure 10. Annual Precipitation From 1960 - 2018

Figure 11 shows the October 2015 hydrograph at the Brazos River at Waco Gage and the peak flow of 37,000 cfs. The hydrograph shows the flow peaked and receded quickly. Later in the year smaller flow peaks occurred in November and December. Quickly rising and falling river levels will impact the condition of the riverbanks as well as smaller, longer duration flows.

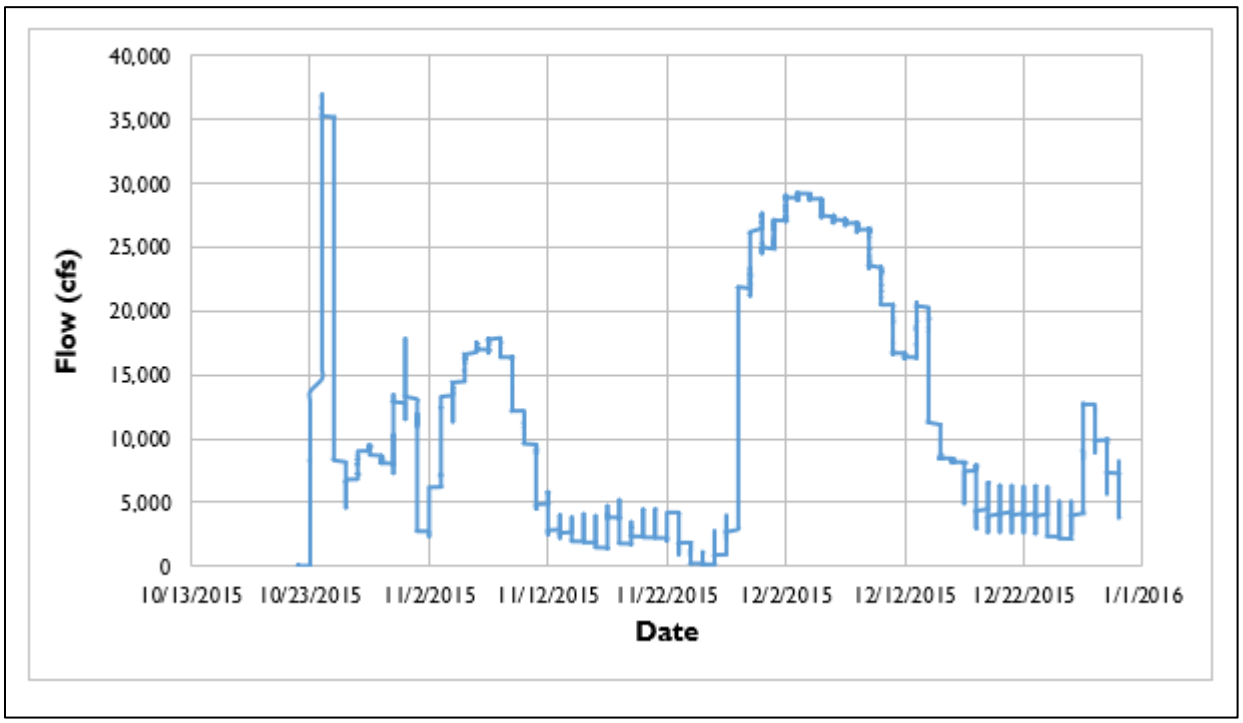

Figure 11. October - December 2015 Hydrograph at Brazos River at Waco Gage

4.2.4 *Groundwater*

The project area is underlain by the Trinity Aquifer. It is primarily recharged by precipitation. The

management of the groundwater resources is regulated by the South Trinity Groundwater Conservation District (STGCD). TCEQ has designated the Trinity Aquifer a priority groundwater management area due to the decline in groundwater levels. The groundwater is pumped for use in municipalities, manufacturing, and livestock (STGCD, 2010).

4.2.5 *Water Quality*

The Texas Commission on Environmental Quality (TCEQ) monitors the state's surface waters under Sections 303(d) and 305(b) of the Clean Water Act. The agency reports concern regarding public health, fitness for use by aquatic species, and specific pollutants to the EPA under these sections. TCEQ has two Surface Water Quality Monitoring (SWQM) stations on the Brazos River near the project site, one upstream (SWQM 12038) and one downstream (SWQM 12037). This section of the Brazos River encompasses Stream Segment 1242 (Brazos River above Navasota River). In the 2018 review of the state's water bodies, TCEQ found this area of the Brazos River to have a High level of Aquatic Life Use (TCEQ, 2019) and did not include the river segment among the List of Impaired Waters.

4.3 Climate

The region has a humid subtropical climate with hot summers. The climate is characterized by extreme variations in temperature. The average annual temperature is 66.9º Fahrenheit (F), with a high in August of 85.7º F and a low in January of 46.9º F. Precipitation averages 33.41 inches per year, with the highest rains seen in the late spring (3.36 inches in April and 4.55 inches in May) and the least amount of rain the summer (1.82 inches in July and 1.83 inches in August) (NOAA, 2020).

4.4 Land Use

The study area is located southeast of the city center of Waco. The Brazos River flows through the project site. The WMARSS Treatment Plant for the City of Waco is located on the right overbank of the Brazos River. The study area is surrounded by agricultural land.

4.5 Wetlands

Wetlands are often defined as areas where the frequent and prolonged presence of water at or near the soil surface drives the natural system. Wetland areas require specific hydrology, soil types (i.e. hydric soils), and plant species that are characterized as requiring wetland habitats.

The USFWS (2020) has mapped wetlands within the study area as part of the National Wetlands Inventory (NWI). Although the USFWS have identified several errors in the national NWI, the database provides a good baseline prior to field identification.

The NWI mapper identifies wetland areas surrounding the project area which include a large freshwater forested/shrub wetland (PFO1A), and the Brazos River, classified as Riverine (R2USA, R2USC, and R2UBH).

4.6 Air Quality

The U.S. Environmental Protection Agency (EPA) has the primary responsibility for regulating air quality nationwide. The Clean Air Act (42 U.S.C. 7401 et seq.), as amended, requires the EPA to set National

Ambient Air Quality Standards (NAAQS) for wide-spread pollutants from numerous and diverse sources considered harmful to public health and the environment.

EPA has set NAAQS for six principal pollutants, which are called "criteria" pollutants. These criteria pollutants include carbon monoxide (CO), nitrogen dioxide (NO2), ozone (O3), particulate matter less than 10 microns (PM10), particulate matter less than 2.5 microns (PM2.5), sulfur dioxide (SO2), and lead (Pb). If the concentration of one or more criteria pollutants in a geographic area is found to exceed the regulated "threshold" level, the area may be classified as a non-attainment area. Areas with concentrations of criteria pollutants that are below the levels established by the NAAQS are considered in attainment.

The project area is in Air Quality Control Region (AQCR) 212 – Austin-Waco. This region includes Bastrop, Bell, Blanco, Bosque, Brazos, Burleson, Burnet, Caldwell, Coryell, Falls, Freestone, Grimes, Hamilton, Hays, Hill, Lampasas, Lee, Limestone, Llano, Madison, McLennan, Mills, Robertson, San Saba, Travis, Washington, and Williamson Counties. This region is in attainment of all NAAQS criteria pollutants (EPA, 2020).

4.7 Geologic Resources

Geologic resources are defined as the topography, geology, soils, and minerals of a given area. The existing physiography, soils, and geomorphology of the study area is a result of complex interactions of geological, hydrological, and meteorological processes.

4.8 Soils

The Farmland Protection Policy Act of 1981 (FPPA) (P.L. 97-98) is intended to minimize the impact of Federal actions on the conversion of prime farmland, unique farmland, or land of statewide or local importance to non-agricultural uses. Farmland consists of cropland, forest land, rangeland, and pastures. Urban lands containing prime farmland soils are not covered under the FPPA.

Prime farmland is land that has the best combination of physical and chemical properties for producing food, feed, forage, fiber, and oilseed crops. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. Unique farmland is land other than prime farmland that is used to produce specific high-value food and fiber crops, such as citrus, tree nuts, olives, cranberries, and other fruits and vegetables. Nearness to markets is also a consideration. Unique farmland is not based on national criteria. Farmland of statewide importance do not meet the qualifications of prime or unique farmland.

Table 3 lists the soil types found in the study area. None of the soils are listed as prime or unique farmlands. Weswood, silt loam, rarely flooded is listed as a hydric soil.

Table 3. Soil types in the WMARSS Treatment Plant Study Area (NRCS, 2020)

Soil Type	Acreage	% of Study Area
Weswood, silt loam, rarely flooded	4.3	34.2
Yahola loam, rarely flooded	2.0	16.2
Water	6.2	49.6

4.9 Biological Communities

4.9.1 *Vegetation*

The cut bank is denuded of vegetation except for scattered pioneer grass and forbs such as knotweeds, cheatgrass, and nut-sedges. The vegetated terrace on the south bank is located 8 to 15 feet above normal high water. The vegetation on the terrace within and adjacent to the wastewater treatment plant consists of maintained Bermudagrass turf. Forested areas occur on the terrace up- and downstream of the wastewater treatment plant on the south eroded cut bank of the river. The forested areas are dominated by hackberry (Celtis laevigata), green ash (Fraxinus pensylvanica), black willow (Salix nigra), and cedar elm (Ulmus crassifolia). Understory vegetation within the forested areas include Texas wintergrass (Nasella leucotricha), Canada wildrye (Elymus canadensis), poison ivy (Toxicodendron radicans), Virginia creeper (Parthenocissus quinquefolia), and peppervine (Ampelopsis arborea).

4.9.2 *Threatened and Endangered Species*

Five ESA-listed species and one candidate species were identified in a species list requested from the USFWS Information, Planning, and Consultation (IPaC) system (Attachment 1): Golden-cheeked warbler (Dendroica chrysoparia), Least tern (Sterna antillarum), Piping plover (Charidrius melodus), Red knot (Calidris canutus rufa), Whooping crane (Grus americana) and the candidate Texas fawnsfoot (Truncilla macrodon). Of the listed species the least tern, the piping plover, and the red knot only need to be considered for wind-related projects.

4.9.3 *Migratory Birds*

The Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703-712) prohibits the take of migratory birds resulting from activities unless authorized by the USFWS. Take includes pursuing, hunting, capturing, and killing of migratory birds or any part of their nests or eggs. The Act also prohibits the sale, purchase, or shipment of migratory birds, nests, or eggs. The MBTA is an international treaty with the U.S., Canada, Mexico, Japan, and Russia. Non-native bird species are not protected under the MBTA.

Six migratory bird species were identified in a species list requested from the USFWS IPaC system: American golden-plover (Pulvialis dominica), Bald eagle (Haliaeetus leucocephalus), Buff-breasted sandpiper (Calidris subruficollis), Harris's sparrow (Zonotrichia querula), Lesser yellowlegs (Tringa flavipes), and Semipalmated sandpiper (Calidris pusilla). The Bald eagle is also protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c).

4.10 Critical Habitat

There is no critical habitat for any species within the study area.

4.11 Cultural Resources

A review utilizing the Texas Historical Commission's (THC) online Texas Archeological Sites Atlas (Atlas) of previous archeological investigations, recorded archeological sites, and cemeteries conducted in May 2020 found no above-ground historic-age (50-years of age) resources within the Area of Potential Effect.

Four previous cultural resources surveys conducted within the study area; in 1979, 2001, 2007, and 2016 found no archeological sites. One previously recorded archaeology site, 41ML231, located 30 meters from the eroding riverbank, was deemed ineligible for listing in the National Register of Historic Places within

that project right of way.

4.12 Noise

The study area is in a mixed area of agricultural and industrial outside the town of Waco. The noise environment in typical of a more rural area; the setting is dominated by vehicular noise. Except for a farmhouse located approximately 0.5 miles from the WMARSS Treatment Plant, no noise receptors are located within a mile of the proposed project area. The proposed project area is not significantly affected by airfield noise. The closest airfield to the proposed project area is Diamondaire Airport, located approximately eight miles north-northwest.

4.13 Hazardous Material

A Phase 1 records search was conducted in accordance to ER 1165-2-132 and revealed four potential Hazardous, Toxic and Radioactive Waste (HTRW) sites in McLennan County although none of these sites have the potential to affect the proposed project. The WMARSS Treatment Plant is located within the impacted area and is the current land use for project lands and there are potential HTRW contaminants presently used, stored and disposed of, on a daily basis and would be considered a contaminant if it spills out of its allotted areas. Treated water can also have contaminant issues and should continue to be tested and processed per regulations. For this project the main concern is the erosion of the banks of the Brazos River and the impact to the WMARSS Treatment Plant. The four possible HTRW locations identified in the records review within one mile of the proposed project have an extremely low potential to impact the proposed project.

4.14 Socioeconomics and Environmental Justice

Waco is the 22nd largest city in the State of Texas with a population of 138,138 based on the 2018 U.S. census estimate data, which is a 10.7% increase from 2010 (U.S. Census Bureau, 2020). Waco is the county seat and the only metropolitan area of McLennan County and functions as the industrial, commercial, distribution, and population core of the county.

McLennan County has a population of 254,607 residents based on the 2018 U.S. census estimate data, an 8.4 percent increase from the 2010 Census (U.S. Census Bureau, 2020). The median household income for the State of Texas in 2018 was $59,570, while the County of McLennan has a median household income of $37,735. The median income for city of Waco was $48,199. 18.9 percent of McLennan County residents are in poverty, compared to 14.9 percent for the State. Racial distribution for City of Waco, McLennan County, and the State are displayed in Table 4.

Table 4. Racial Distribution of the Study Area.

Race	Waco (City)%	McLennan County%	Texas (State)%
White/Not Hispanic or Latino	42.6	55.6	41.5
Hispanic or Latino	32.4	26.7	39.6
African American	21.6	14.9	12.8
Two or more races	2.4	2.1	2
Asian	2.2	1.8	5.2
American Indian/Alaska Native	0.5	1.1	1
Native Hawaiian/Pacific Islander	0.1	0.1	0.1

4.15 Aesthetics

Visual resources are defined as the natural and manufactured features that comprise the aesthetic qualities of an area. These features form the overall impressions that an observer receives of an area or its landscape character. Landforms, water surfaces, vegetation, and manufactured features are considered characteristic of an area if they are inherent to the structure and function of a landscape.

The study area is predominately agricultural. Relatively undeveloped land is found in the areas adjacent to the study area with increasing development nearer the City of Waco. The visual aesthetics of these areas is typical of rural and riverine environments.

4.16 Recreation

This area of the Brazos River is not known for being a major area for paddling or kayaking. This segment of the river is not included among the Texas Paddling Trail list of Inland Trails. Swimming is not recommended due to high currents and muddy water.

4.17 Alternative Plans Considered

In accordance with the guidelines outlined in ER 1105-2-100, the development and evaluation of alternatives reflected the magnitude and scope of a Section 14 study. The initial array of measures included a longitudinal dike, stone riprap, gabion wall, and articulated concrete block. The alternatives for addressing the imminent threat to the remainder of the outfall pipe at the wastewater treatment facility considered typical structural solutions using the following steps:

- Identify the slope instability problem
- Identify the cause(s) of the slope instability problem
- Develop alternatives based on engineering judgment and experience that address the slope instability problem threatening the wastewater treatment plant
- Based on engineering judgment and experience, decide on the alternative that would address the slope instability problem in the least costly manner

4.17.1 ***No Action***

If no action is taken, riverbank erosion will continue. Eventually the functioning of the WMARSS Treatment Plant will be impacted with loss of structures positioned close to the slope, impeding the ability of the WMARSS Treatment Plant to treat wastewater. Stated earlier, erosion has been encroaching on the plant over the last ten years due to high flows in the river from various storm events within the watershed causing an approximate erosion rate of seven feet per year.

4.17.2 ***Alternative 1 - Longitudinal Peaked Stone Dike and Tie Back***

Alternative 1 consists of a longitudinal peaked stone toe dike placed at the toe along a 1,300-feet section upstream of exiting riprap bank protection and 300 feet section downstream of existing riprap on the right bank of the Brazos River. The upstream reach of the stone toe dike would begin at Station 0+00, north of the City of Robinson intake structure. The downstream reach of the stone dike would run adjacent to the Sandy Creek Pump Station. The existing bank should be dressed up by placing fill material at a slope of 1V:2H. The longitudinal stone toe dike would have a triangular cross section with an approximate height of eight

feet, a base width of about 48-feet, and 3H:1V side slopes. The entire 1,600-foot reach of the longitudinal stone toe dike would have stone tie-back dikes extending out perpendicularly from the crest of the longitudinal stone dike to the bank and would be spaced every 100-feet along the longitudinal stone dike. The crest height of the tie-back dikes would match the crest height of the longitudinal stone dike at the juncture of the two and would slope up toward the bank on a slope of 5H:1V. The tie-back dikes would be keyed into the bank three feet below the existing ground. The exposed embankment would be planted with native vegetation. This alternative has an estimated cost of $14,781,000 and would require approximately 31,200 cubic yards of riprap material into the river channel, 26,200 cubic yards of fill material to dress up bank and 9,400 square yards of native vegetation.

4.17.3 *Alternative 2 – Stone Riprap Toe Protection*

Alternative 2 consists of stone riprap placed at the toe along approximately 1,300-feet upstream of existing riprap bank protection and 300 feet downstream of existing riprap on the right bank of the Brazos River. The upstream reach of the riprap would begin at Station 0+00, north of the City of Robinson intake structure. The downstream reach of the riprap would run adjacent to the Sandy Creek Pump Station. The existing bank should be dressed up by placing fill material at a slope of 1V:2H. An 18-inch thick stone riprap layer will be placed along the toe of the dressed-up bank and extend to the top of bank to provide erosion protection to the toe of the bank from river scour. This alternative has an estimated cost of $7,298,000 and would require approximately 26,200 cubic yards of fill material to dress up bank, 7,400 cubic yards of riprap material, 3,700 cubic yards of bedding material into the river channel.

4.17.4 *Alternative 3 – Longitudinal Peaked Stone Toe Protection with Bendway Weirs*

Alternative 3 consists of bendway weirs constructed of stone in combination with a longitudinal peaked stone toe dike placed at the toe along approximately 1,300-feet section upstream of exiting riprap bank protection and 300 feet section downstream of existing riprap on the right bank of the Brazos River. The upstream reach of the stone toe dike would begin at Station 0+00, north of the City of Robinson intake structure. The downstream reach of the stone dike would run adjacent to the Sandy Creek Pump Station. The existing bank should be dressed up by placing fill material at a slope of 1V:2H. The weirs have a trapezoidal cross-section about 4 feet in height, a five-foot crest width, 2H:1V side slopes and would slope downward toward the center of the riverbed on a 20H:1V slope. The weirs would be spaced every 100 feet and would extend out toward the centerline of the riverbed 15 feet from the longitudinal stone toe dike. The weirs are angled upstream approximately 10 to 15 degrees from the radius of the bend to direct flow away from the bank toward the center of the riverbed. The bendway weirs would extend up the bank on a 3H:1V slope to intersect bank, continuing up the slope at 2H:1V, with a key-in 3 feet below top of bank. This alternative has an estimated cost of $15,091,000 and would require approximately 25,000 cubic yards of riprap material into the river channel, 26,200 cubic yards of fill material to dress up bank and 10,500 square yards of native vegetation.

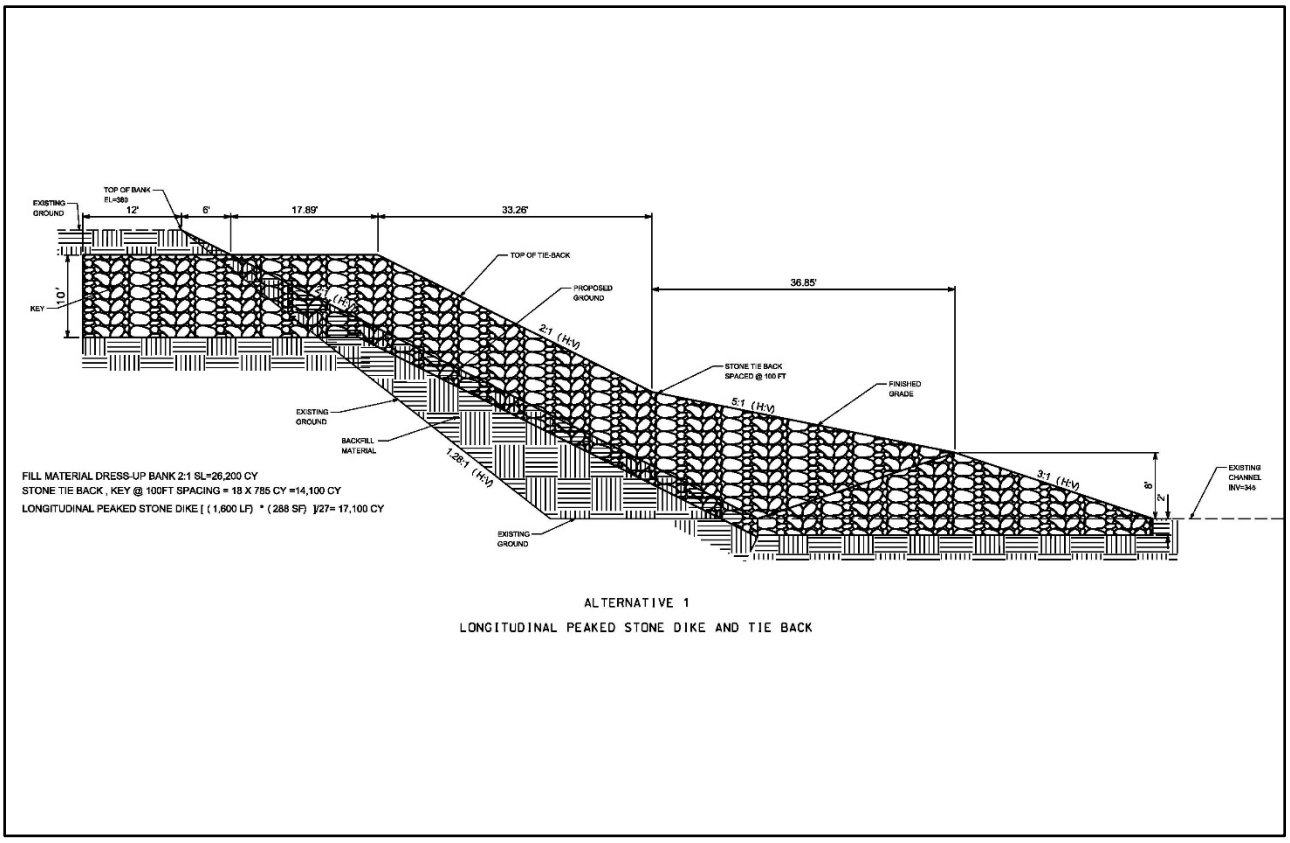

Figure 12. Alternative 1 - Longitudinal Peaked Stone Dike and Tie Back

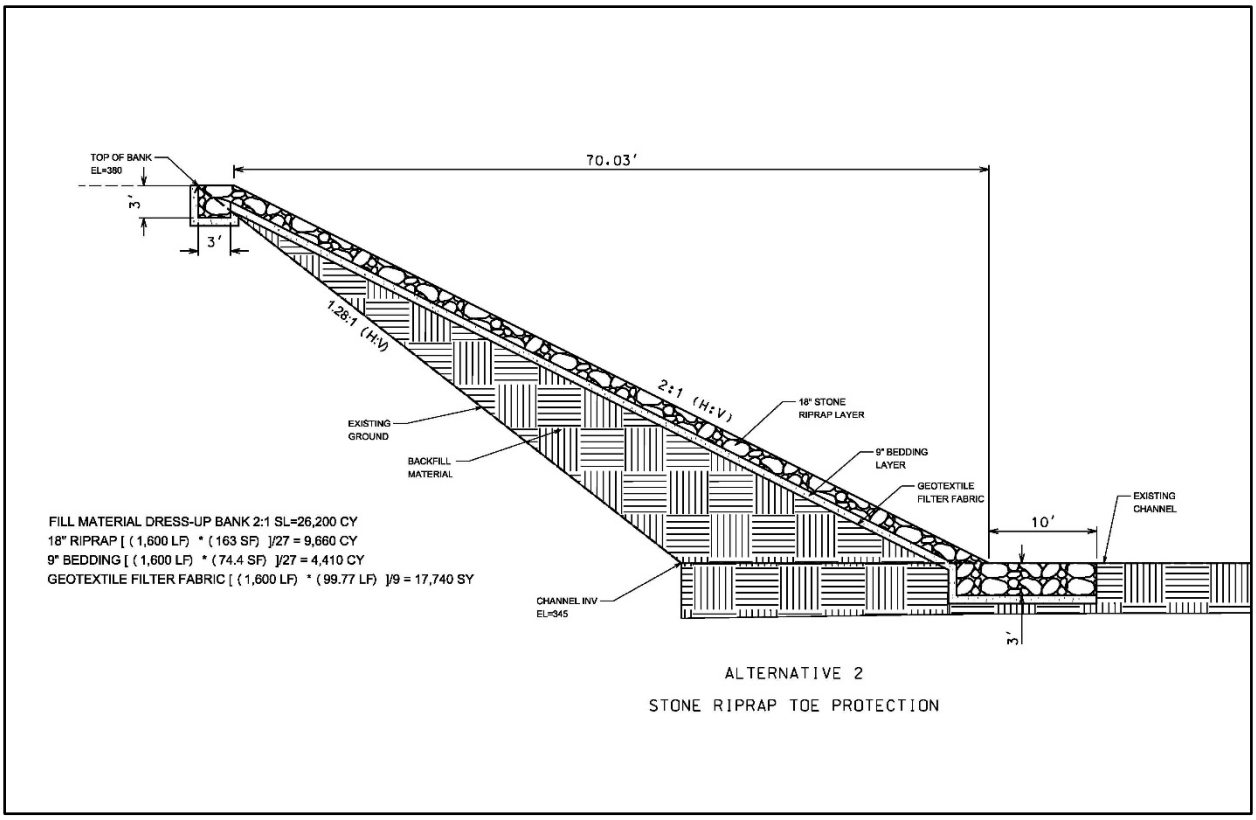

Figure 13. Alternative 2 – Stone Riprap Toe Protection

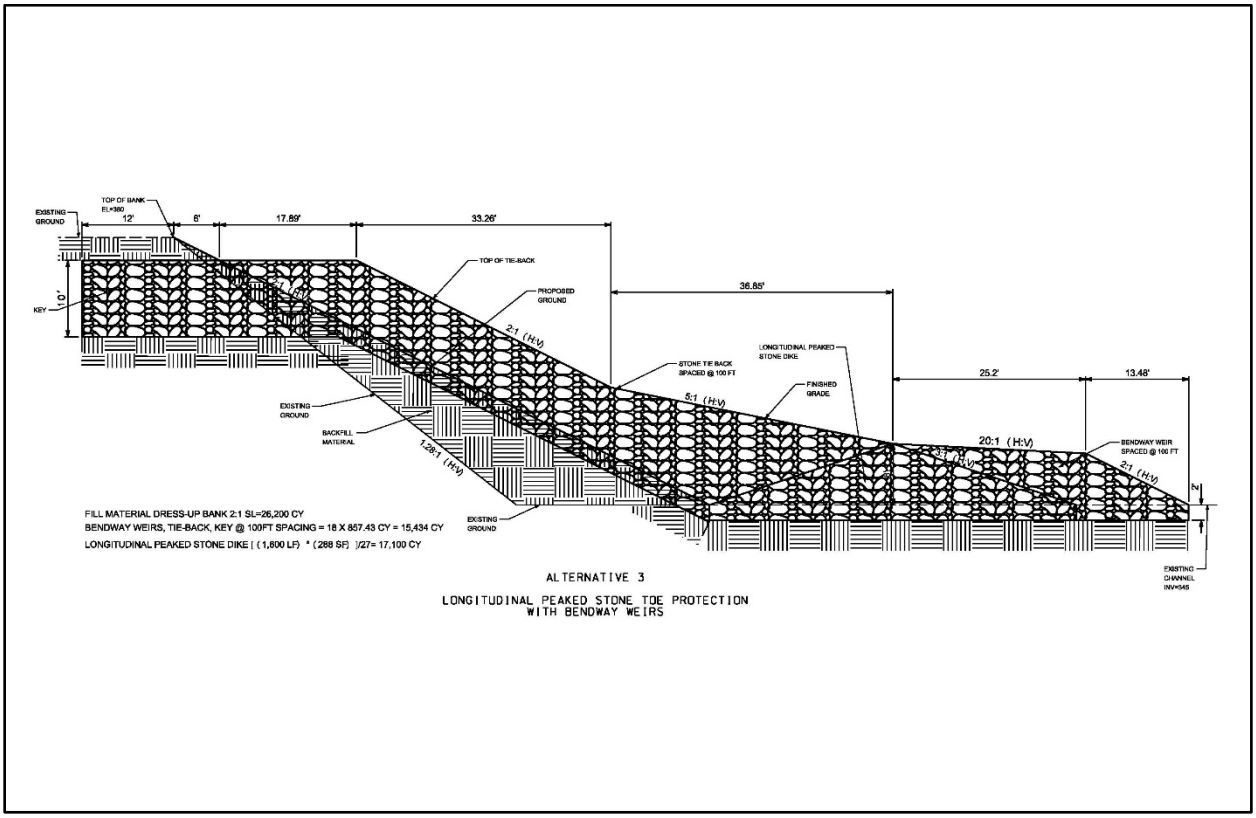

Figure 14. Alternative 3–Longitudinal Peaked Stone Toe Protection with Bendway Weirs

4.18 Screened Alternatives

The following those alternatives developed early in the study process but that were later screened.

4.18.1 *Alternative 4 – Reinforced Earth Fill with a Gabion Face*

Alternative 4 consists of a reinforced earth wall with a gabion face that begins at an invert elevation 3 feet below the river flowline and rises to elevation where the top of the structure is approximately halfway up the riverbank. Reinforcing strips attached to each gabion basket are estimated to be 12 feet long. The foundation for the earth wall would consist of 4 feet of rock. The toe of the wall would also be protected by mounding a layer of rock approximately 15 feet wide and 10 feet high in front, and covering, the first two layers of baskets. The ground at the top of the earth wall would be sloped back on a 3H:1V slope. The estimated length of protection is 1,100 feet. This alternative has an estimated cost of $3,382,000 and would require approximately 27,540 cubic yards of combined fill material into the river channel.

Based on the Fort Worth District experience with gabion systems, this alternative was dropped from further consideration since gabion wire fabric is subject to abrasion and tearing, spilling the rock fill in instances of high velocity streams and wave interaction. Floating debris (tree limbs and branches), prevalent in the Brazos River, can damage the gabion wire fabric thereby compromising the riverbank protection system. Gabion systems must also be inspected and evaluated immediately after any storm that produces heavier than normal water flow. Frequent damage to the gabion wire fabric would likely increase annual maintenance costs as compared to other alternatives.

4.18.2 *Alternative 5 – Dressed up Slope with Articulated Concrete Block Face*

Alternative 5 consists of stone riprap placed at the toe along approximately 1,100-feet of the right bank of the Brazos River to a height of 5 feet above the river flowline then placing a granular backfill material with a articulated concrete block face on a 1V:2H slope. The top will be keyed into the bank slope and the finished face will be filled with topsoil and vegetated with native grasses. This alternative has an estimated cost of $2,684,000 and would require the placement of approximately 24,450 cubic yards of combined fill material into the river channel. This alternative however would not adequately address the riverbank erosion since a grassed slope is not adequate to resist the Brazos River current and forces. The cost of installation of articulated concrete blocks from the toe of the riverbank to the top would likely exceed the costs of the other alternatives. The foundation preparation and installation of the articulated concrete blocks are critical elements for a functioning riverbank protection system, if not properly done, will compromise the effectiveness of the riverbank slope protection.

4.18.3 *Alternative 6 – Relocation of Wastewater Treatment Plant Facility*

Alternative 6 consists of locating a site of approximate size that would be able to serve the same areas. The facilities would need to be rebuilt as wastewater treatment plants are designed to be site specific and many of the facilities are unable to be relocated. Rebuilding the WMARSS Treatment Plant would include the buildings, pipes, storage facilities, and land acquisition. This alternative has an estimated cost of $350,000,000 to $400,000,000. This cost does not include the removal and required HTRW remediation of the current WMARSS Treatment Plant site.

5 Selecting the Recommended Plan

As prescribed in ER 1105-2-100, evaluation and formulation should focus on the least cost alternative plan, and that plan is considered economically justified if the total cost of the proposed alternative is less than the cost to relocate the threatened facility. The cost of constructing a new plant should be a reasonable parametric cost for relocating the existing facility. For this evaluation, the construction cost of a new plant of similar capacity (42 million gallons per day (gpd)) was estimated from the RS Means Construction Cost Estimation. The construction cost of a similar capacity sewage treatment plant would range from $7.70 per gpd to $8.45 per gpd, or $347 million to $380 million. For a conservative comparison, the lower estimate was used, and given the magnitude of the cost, neither real estate costs nor costs of decommissioning of the existing plant were included.

First costs for Alternatives 1, 2 and 3 were developed and are presented in Table 5.

Table 5. Estimated First Costs for Alternatives 1, 2 and 3, October 2021 Prices

Construction Item	Alternative 1	Alternative 2	Alternative 3
01 - Lands and Damages	$88,000	$88,000	$88,000
16 - Bank Stabilization	11,757,000	5,768,000	12,004,000
30 - Planning, Engineering, and Design	1,878,000	922,000	1,919,000
31 - Construction Management	1,058,000	520,000	1,080,000
Project First Cost	**$14,781,000**	**$7,298,000**	**$15,091,000**

Operations, Maintenance, Repair, Rehabilitation and Replacement (OMRR&R) costs were developed for the three action alternatives, and the annualized estimate is $3,000. OMRR&R costs for the no federal action plan (constructing a new plant) are assumed to be the same as the existing facility, therefore a sunk cost.

Estimated first costs for each alternative, the estimated cost of constructing a new plant (no federal action alternative), average annual OMRR&R costs, and average annual costs are presented in Table 6. All three alternatives are economically justified since they are less than the annual cost to relocate the plant. Alternative 2 is the least costly alternative of the three alternatives, comparing first costs $7.3 million) and average annual c*osts ($265 thousand).*

Table 6. Estimated First Costs, Investment Costs, Average Annual OMRR&R, and Average Annual First Costs ($1,000, October 2021 Prices, 2.5% Interest Rate, 50-year period of analysis)

Investment	Alternative 1	Alternative 2	Alternative 3	Relocation the Plant
Estimated First Cost	$14,781	$7,298	$15,091	$347,000
Annual Interest Rate	2.5%	2.5%	2. 5%	2.5%
Period of Analysis (years)	50	50	50	50
Interest During Construction	$277	$137	$283	$9,077
Investment Costs	$15,058	$7,435	$15,374	$356,077
Annual Costs				
Interest	$376	$186	$384	$8,902
Amortization	$155	$76	$158	$3,653
OMRR&R	$3	$3	$3	
Average Annual Costs	**$534**	**$265**	**$545**	**$12,555**

5.1 Recommended Plan

Alternative 2 is the most economical solution to the slope instability problem. This would protect the bank from further erosion and prevent the loss of the outflow pipe which would ultimately impair the function of the

WMARSS Treatment Plant. As previously stated, the plan restores the slope by placing stone riprap placed at the toe along approximately 1,300-feet upstream of existing riprap bank protection and 300 feet downstream of existing riprap on the right bank of the Brazos River. The upstream reach of the riprap would begin at Station 0+00, north of the City of Robinson intake structure. The downstream reach of the riprap would run adjacent to the Sandy Creek Pump Station. The existing bank should be dressed up by placing fill material at a slope of 1V:2H. An 18-inch-thick stone riprap layer will be placed along the toe of the dressed-up bank and extend to the top of bank to provide erosion protection to the toe of the bank from river scour. This alternative would require approximately 26,200 cubic yards of fill material to dress up bank, 7,400 cubic yards of riprap material, 3,700 cubic yards of bedding material into the river channel. This plan reduces the immediate vulnerability to erosion over the non-Federal Action Alternative and comparable to Alternatives 1 and 3, but at a lower cost.

6 Environmental Consequences

The environmental consequences describe the probable effects or impacts of implementing any of the action alternatives (the Future with Project condition or FWP). Effects can be either beneficial or adverse and are considered over a 50-year period of analysis (2022-2072).

Environmental impacts will be assessed according to state environmental regulations (HRS 343 and HAR 11-200), as well as federal guidelines (NEPA). Descriptions of the assessment criteria under both state and federal guidelines are presented below.

6.1 Water Resources

The following describes the potential impacts to water resources under the No Action scenario and under the action alternatives scenarios.

6.1.1 *Floodplains*

No Action Alternative – Under the No Action Alternative, no fill material would be introduced into the proposed project area. The cut bank on the WMARSS Treatment Plant side of the river would continue to migrate and the floodplain would be modified to accommodate the changes in the rivers path.

Action Alternatives

Alternative 1 - Longitudinal Peaked Stone Dike and Tie Back entails the placement of 31,000 cubic yards of riprap material into the river channel, 26,200 cubic yards of fill material to dress up bank and 9,400 square yards of native vegetation to be placed over a 1,600-foot long section of the Brazos River adjacent to the wastewater treatment plant. To meet the design specifications, portions of the bank would need to be excavated to prepare the site for the placement of the riprap material. The net difference between the excavated material and placed matter would result in negligible impacts to the existing floodplain profile.

Alternative 2 – Stone Riprap Toe Protection consists of the placement of approximately 26,200 cubic yards of fill material to dress up bank, 7,400 cubic yards of riprap material, and 3,700 cubic yards of bedding material to be placed over a 1,600-foot long section of the Brazos River adjacent to the wastewater treatment plant. To meet the design specifications, portions of the bank would need to be excavated to prepare the site for the placement of the riprap material. The net difference between the excavated material and placed matter would result in negligible impacts to the existing floodplain profile.

Alternative 3–Longitudinal Peaked Stone Toe Protection with Bendway Weirs entails the placement of approximately 25,000 cubic yards of riprap material into the river channel, 26,200 cubic yards of fill material to dress up bank and 10,500 square yards of native vegetation to be placed over a 1,600 foot long section of the Brazos River adjacent to the wastewater treatment plant. To meet the design specifications, portions of the bank would need to be excavated to prepare the site for the placement of the riprap material. The net difference between the excavated material and placed matter would result in negligible impacts to the existing floodplain profile.

6.1.2 *Groundwater*

The No Action and Action Alternatives would not result in any changes to groundwater recharge or withdrawal of groundwater from the Trinity Aquifer.

6.1.3 *Water Quality*

No Action Alternative – suspended sediments from the eroded banks would continue to enter the water column during channel forming flow events. However, the volume of sediments introduced from the eroded bank would be negligible compared to the volume of sediments being transported by the Brazos River. The No Action Alternative would not result in any temporary impacts to the river as no construction or ground disturbing impacts resulting from bank stabilization would occur.

Action Alternatives – each would have similar direct water quality impacts resulting from construction activities associated with excavation, grading, and placement of the riprap. During construction, bank and ground disturbing activities would temporarily degrade water quality. Erosion and sedimentation controls would be required during construction, such as silt curtains, silt fencing, sediment traps, and other sediment control methods. Revegetation of disturbed areas would be prompt to reduce and control siltation or erosion impacts. Every construction project poses a potential contamination risk from petroleum or chemical spills. The contractor would be required to prepare and follow a site-specific spill prevention plan to reduce the risk of such contamination. The plan would include best management practices (BMPs) such as proper storage, handling and emergency preparedness. Anticipated impacts to surface waters during construction would be temporary and minimal with the implementation of appropriate BMPs.

A 404(b)(1) water quality assessment report has been drafted and is being coordinated with TCEQ (Water Quality Appendix).

6.2 Climate

The proposed project encompasses a relatively small area when compared to the global scale. Therefore, any changes with respect to climate change resulting from the No Action and Action Alternatives would be negligible.

6.3 Land Use

No Action Alternative and Action Alternatives – The proposed project area is located along the Brazos River at the WMARSS Treatment Plant. The area would remain in control of the WMARSS Treatment Plant. No changes in land use would occur as the result of the No Action Alternative. Further erosion of the Brazos Riverbank would occur, threatening the integrity of the WMARSS Treatment Plant.

6.4 Wetlands

No Action Alternative – Under the No Action Alternative, the Brazos River would continue to migrate into the eroded cut bank extending the R2UBH wetland to the south. Typical of dynamic river systems, the inside bend along the north bank of the river would begin to shoal as the river migrated into the cut bank. As the river migrates into the southern cut bank, the forested palustrine wetland (PFO1A) located at the top of the cut bank downstream of the existing riprap would eventually be lost as the high bank sloughs off into the river. As the southern boundary of these wetlands are bordered by the levee surrounding the wastewater treatment plant, there would be nowhere for these forested wetlands to migrate; therefore, the future without project conditions associated with the No Action Alternative would result in a shift of the riverine wetlands and a net loss of forested wetlands downstream of the existing riprap.

Action Alternatives – Each of the Action Alternatives would result in the placement of riprap along the south cut bank 1,300 linear feet upstream and 300 linear feet downstream of the existing wetland. The riprap would stabilize the eroded cut bank keeping the river from migrating into the bank. The placement of the riprap would change the bed material from an unconsolidated bottom to a hardened rocky bottom along the southern outside bend of the river along the 1,600 feet of proposed reinforcement of each of the Action Alternatives.

The three Action Alternatives would also result in impacts to approximately 0.3 acres of palustrine forested wetlands (PFO1A) downstream of the existing riprap as this area would need to be cleared for the construction of the bank stabilization. However, it is anticipated that the future without project condition would result in not only the loss of the 0.3 acres of impacted wetlands, but that the future erosion would continue further downstream into the remaining forested wetlands. Although each of the action alternatives would result in the loss of 0.3 acres of forested wetlands, the stabilization of the bank would protect the remaining wetland habitats downstream of the proposed project area. Therefore, each of the Action Alternatives would result in a net increase of forested wetland habitats (i.e. protection of existing forested wetlands) when compared to the future without project conditions.

6.5 Air Quality

No Action Alternative – would result in no impacts to air quality in the proposed project area.

Action Alternatives – each would generate air pollutant emissions as a result of excavation, grading, placement of riprap, and other ancillary activities. These emissions would be temporary and would not be expected to generate offsite effects or exceed federal air quality standards.

The construction activities would result in short-term emissions of criteria pollutants as combustion products resulting from construction and transportation equipment. Construction activities would also generate particulate matter emissions, such as fugitive dust. Fugitive dust is particulate matter, solid particles that come from the soil, that become suspended in the air by wind and human activities. Fugitive dust emissions would be greatest during initial site preparation activities and would vary daily depending on the construction phase, level of activity, and prevailing weather conditions. The quantity of uncontrolled fugitive dust emissions from a construction site is generally proportional to the area of land being worked and the level of construction activity. Appropriate dust control measures would be employed to suppress emissions, such as using mulch, water sprinkling, temporary enclosures, and other appropriate methods as needed.

The Action Alternatives would generate similar quantities of emissions which would fall below de minimis levels. Waco is classified as an attainment area for all criteria pollutants. Therefore, General Conformity Rule requirements would not be applicable. The construction contractor would be required to use low greenhouse gas-emitting vehicles to the extent possible and available, such as clean diesel technologies.

6.6 Geologic Resources

No changes to geologic resources would occur under the No Action and Action Alternatives.

6.7 Soils

The No Action and Action Alternatives would not reduce the acreage of prime farmland, unique farmland, or soils of agricultural importance. The proposed project area is not used for agriculture and the Action Alternatives are in compliance with the Farmland Protection Policy Act of 1981.

Action Alternatives – Under each Action Alternative, the wastewater treatment plant property would be protected and no changes in land use would occur.

6.8 Biological Communities

The following describes the potential impacts to biological communities under the No Action scenario and under the action alternatives scenarios.

6.8.1 *Vegetation*

No Action Alternative – there would be no clearing of vegetation associated with bank armoring activities. The south cut bank would continue to erode, resulting in the loss of forested habitats up- and downstream of the existing riprap armored bank.

Action Alternatives – each would have a similar impact of vegetation resources in the proposed project area as each alternative would result in the armoring of approximately 1,600 linear feet of shoreline utilizing different methods. The proposed alternatives would result in the removal of approximately 0.4 acres of woodland upstream of the wastewater treatment plant and approximately 0.3 acres of forested wetland downstream of the existing riprap on the south bank. The remaining vegetation within the proposed project area consists of maintained Bermudagrass turf along the wastewater treatment plant levee and adjacent areas. As discussed in Section 5.6.2, the Future without Project Condition of the proposed project area would result in the loss of the forested habitats as the uncontrolled erosion would continue to slough the cut banks. Therefore, the Action Alternatives would protect the forested habitats.

The 0.3 acres of wetlands would be protected by placing mats over the wetland during construction and minimizing construction activities in the wetland. The loss of the vegetation in the forested wetland would be mitigated by replanting the site with native tree species after completion is completed.

6.8.2 *Threatened and Endangered Species*

As discussed previously, the Least Tern, Piping Plover, and Red Knot only need to be assessed for wind-related projects; therefore, the No Action and Action Alternatives would have "no effect" on these species. The No Action and Action Alternatives would also have "no effect" on the Golden-cheeked Warbler and

Whooping Crane as no suitable habitat for these species occur within the proposed project area.

Populations of the Texas fawnsfoot are known to occur in the Brazos River near the proposed project area. As the Texas fawnsfoot is a Candidate species and no effects determinations are required under Section 7 of the ESA, no formal consultation with the USFWS is required. However, discussions with resource agency staff have indicated that there is a high probability of the Texas fawnsfoot soon being listed as threatened or endangered. Therefore, USACE will be requesting a Conference Opinion from the USFWS to document avoidance and minimization measures to be implemented if the mussels are listed prior to the completion of the proposed project. Due to the status and ecological importance of the Texas fawnsfoot, USACE will implement mitigation measures where feasible that may include mussel surveys and relocation of the mussels to adjacent areas.

6.8.3 *Migratory Birds*

No Action Alternative – habitat for migratory birds would be lost as the forested areas in the proposed project area would be lost due to the uncontrolled erosion of the south bank. The remaining habitat (maintained non-native grasses) provides minimal habitat for migratory birds.

Action Alternatives – there is potential for harm and/or harassment of nesting migratory birds during construction of the Action Alternatives. Attempts will be made to initiate clearing activities outside of the breeding season (September to February) to minimize impacts to migratory birds. If clearing activities must be conducted during the breeding season, nest surveys should be conducted to identify active nests in the planned cleared areas. Coordination with the USFWS should be completed prior to clearing activities if nesting is identified and USFWS guidelines should be followed to avoid adverse impacts to migratory birds.

Each of the proposed Action Alternatives would protect the forested habitats from loss to erosion. Therefore, the Action Alternatives would ensure that this migratory bird nesting habitat would be available in the future.

6.9 Critical Habitat

Since there is no critical habitat for any species within the study area, there are no impacts.

6.10 Cultural Resources

No Action Alternative – Under the No Action Alternative, no fill material would be introduced into the proposed project area. The cut bank on the wastewater treatment plant side of the river would continue to erode, potentially exposing unknown archeological sites. This would not constitute an undertaking under the National Historic Preservation Act of 1966 as amended.

Action Alternatives – all action alternatives would either place riprap into the river channel and fill material to dress up bank and native vegetation over a 1,600-foot long section of the Brazos River adjacent to the wastewater treatment plant. For each of the alternatives no excavation is anticipated, and any borrow material will be from commercial sources. No cultural resources were found to exist in the area of potential effect. Placement of riprap will be on previously disturbed material. Thus all of the action alternatives would have no potential to cause effects, as per 36 CFR §800.3(a)(1).

6.11 Noise

No Action Alternative – there would be no noise impacts to the surrounding environment.

Action Alternatives – all would require the use of construction equipment such as backhoes, bulldozers, dump trucks, etc. during the construction of the proposed project. The resulting noise impacts would be temporary. As the nearest receptor is located over 0.5 miles from the proposed project area, the temporary noise impacts would be minimal.

6.12 Hazardous Material

No Oil or Gas wells or pipelines were identified within the project vicinity and no other HTRW implications were found. Refer to the HTRW appendix for more information and maps of the results.

6.13 Socioeconomic and Environmental Justice

The proposed project area is not located within any residential area; therefore, there would not be any disproportionate impacts on protected low income or minority populations. In addition, there are no areas where children may congregate near the proposed project area.

6.14 Aesthetic Resources

No Action Alternative – visual aesthetics of the proposed project area would remain relatively unchanged. The riverbank would continue to erode resulting in a steep, unvegetated cutbank.

Action Alternatives – all would modify the aesthetics of the riverbank by the placement of stone riprap along the riverbank. The exposed bank would then be planted with native vegetation. Therefore, the aesthetics of the proposed project area would change from an exposed, eroded, unvegetated cut bank to a vegetated shoreline with stone riprap.

6.15 Recreation

No Action Alternative – there would be no impacts to recreational fishing from boats in the proposed project area.

Action Alternatives – all would result in temporary impacts to recreational fishing from boats as construction activities would alter the behavior of aquatic life. In addition, safety concerns would prohibit the encroachment of boats during active construction. There are no other potential recreation opportunities within the project area.

7 Cumulative Impacts

This section addresses the cumulative impacts associated with the implementation of the Recommended Plan and other concurrent/future activities affecting the environment.

7.1 Past Activities

In 2002, USACE constructed a project at the WMARSS Treatment Plant through the authority of Section 14. This project was to repair erosion along the right bank of the Brazos River. This project protected the treatment plant and a 72-inch outfall pipe for the treatment plant. This project is inspected annually by the

Fort Worth District. The City of Waco is the Local Sponsor.

7.2 Present and Reasonably Foreseeable Future Activities

Present and future activities occurring in the project area would be the continued maintenance of the area, low impact recreation such as kayaking or fishing, and development of the nearby residential community.

7.3 Cumulative Impacts with Recommended Plan

The Recommended Plan would not add any significant cumulative impacts to soils, air quality, noise, existing land use, aesthetic resources, social economic, environmental justice, potential presence for hazardous materials, existing flood plains, terrestrial/aquatic wildlife, endangered or threatened species, and surface or ground water resources.

The recommended alternative, placing stone riprap placed at the toe along approximately 1,300-feet upstream of existing riprap bank protection and 300 feet downstream of existing riprap on the right bank of the Brazos River would have minor temporary impacts to resources within the project vicinity. Temporary impacts would include short-term emissions of criteria pollutants from construction and transportation equipment. Construction activities would also generate particulate matter emissions, such as fugitive dust and would be greatest during initial site preparation activities varying depending on the construction phase, level of activity, and prevailing weather conditions. Appropriate dust control measures would be employed to suppress emissions, such as using mulch, water sprinkling, temporary enclosures, and other appropriate methods as needed.

Water quality would also temporarily degrade during construction due to bank and ground disturbing activities. Erosion and sedimentation controls would be required during construction, such as silt curtains, silt fencing, sediment traps, and other sediment control methods. Revegetation of disturbed areas would be prompt to reduce and control siltation or erosion impacts.

Stabilization of the stream bank would prevent further erosion encroaching on the WMARSS Treatment Plant. The future without project condition would result in not only the loss of the 0.3 acres of impacted wetlands, but erosion would continue further downstream into the remaining forested wetlands. Although the recommended plan would result in the loss of 0.3 acres of forested wetlands, the stabilization of the bank would protect the remaining wetland habitats downstream of the proposed project area. Therefore, the recommended plan would result in a net increase of forested wetland habitats compared to the future without project conditions.

8 Regulatory Component

Section 404 (b)(1) of the Clean Water Act of 1972 requires that any recommended discharge of dredged or fill material into waters of the United States must be evaluated using the guidelines developed by the Administrator of the U.S. Environmental Protection Agency (EPA) in conjunction with the Secretary of the Army. These guidelines are located in Title 40, Part 230 of the Code of Federal Regulations. A Section 404 (b)(1) evaluation (Environmental Appendix) analyzes all activities associated with the Recommended Plan that involving the discharge of dredged or fill material into waters of the United States.

The 404(b)(1) report Section 404 of the Clean Water Act (CWA) will be submitted to the Texas Commission on Environmental Quality (TCEQ) for water quality certification under Section 401 of the

CWA.

Section 402 of the Clean Water Act and Chapter 26 of the Texas Water code require construction activities that disturb areas greater than 1 acre to obtain a National Pollution Discharge Elimination System (NPDES) Construction General Permit. Bank stabilization construction operations would meet water quality standards set forth by Section 402 of the Clean Water Act and Chapter 26 of the Texas Water Code by preparing and following a Storm Water Pollution Plan (SWPPP) approved by the USACE and the Texas Commission of Environmental Quality (TCEQ). This SWPPP would outline measures for the contractor to implement during construction activities to minimize pollution in storm water runoff. A TCEQ Notice of Intent (NOI) would be filed at least 48 hours prior to any ground disturbing activities. As required a copy of this NOI and the prepared SWPPP would be posted on site.

9 Best Management Practices

Final project designs would use measures to avoid and minimize impacts to natural and cultural resources. The following is a list of measures that would be used to mitigate impacts to natural and cultural resources.

- No excessive fill material would be used for stream bank protection.
- Dust control would be used during construction.
- Use of heavy equipment would be limited to only essential equipment required to perform necessary repair tasks and no more than 10 hours per day in order to limit noise and air emissions.
- Heavy equipment would operate on matting and would not remain in the Brazos River channel for prolonged periods of time.
- Appropriate soil erosion and sediment controls would be used and maintained in effective operating condition during construction, and all exposed soils would be permanently stabilized at the earliest practicable date.
- As much as possible, construction work would be performed during periods of low or no flow.
- Vegetation lost during clearing and grading activities would be replaced with native vegetation on a one-to-one basis.
- Impacts to undisturbed portions of the riverbank will be minimized to the utmost extent practicable. It is expected that heavy machinery will have to traverse stable sections of the riverbank during construction. The impacts associated with these activities will be minimized through the use of Best Management Practices, possibly construction matting.

10 Public Involvement

To be completed following public review

11 Real Estate

The proposed project impacts seven tracts of land. Four are currently owned in fee by the City of Waco. Two are owned by the City of Robinson, and one is owned by a private landowner. The three bank protection easements will require coordination with the General Land Office of Texas (GLO). SWF Real Estate will work with the City of Waco to begin the coordination with GLO. The Brazos River Authority (BRA) - the City of Waco has currently begun coordination with BRA. The acquisition of all property is pursuant to PL 91-646. When a property is occupied (both residential and commercial) the owners and/or tenants may be eligible for relocation and moving expenses.

Appraisal district data and current local listings were used to determine the value per acre for the different properties. All the proposed project lands are within the floodplain. For waterfront floodplain lands, appraisal district and local listing values varied from $10,095 per acre to $15,725. Based on the data gathered, a value of $13,500 was used after comparing the appraisal district values and current local listings. For the non-waterfront floodplain lands, appraisal district data and local listing values varied from $2,875 per acre to $5,525. Based on the data gathered, a value of $3,500 was used after comparing the appraisal district values and current local listings.

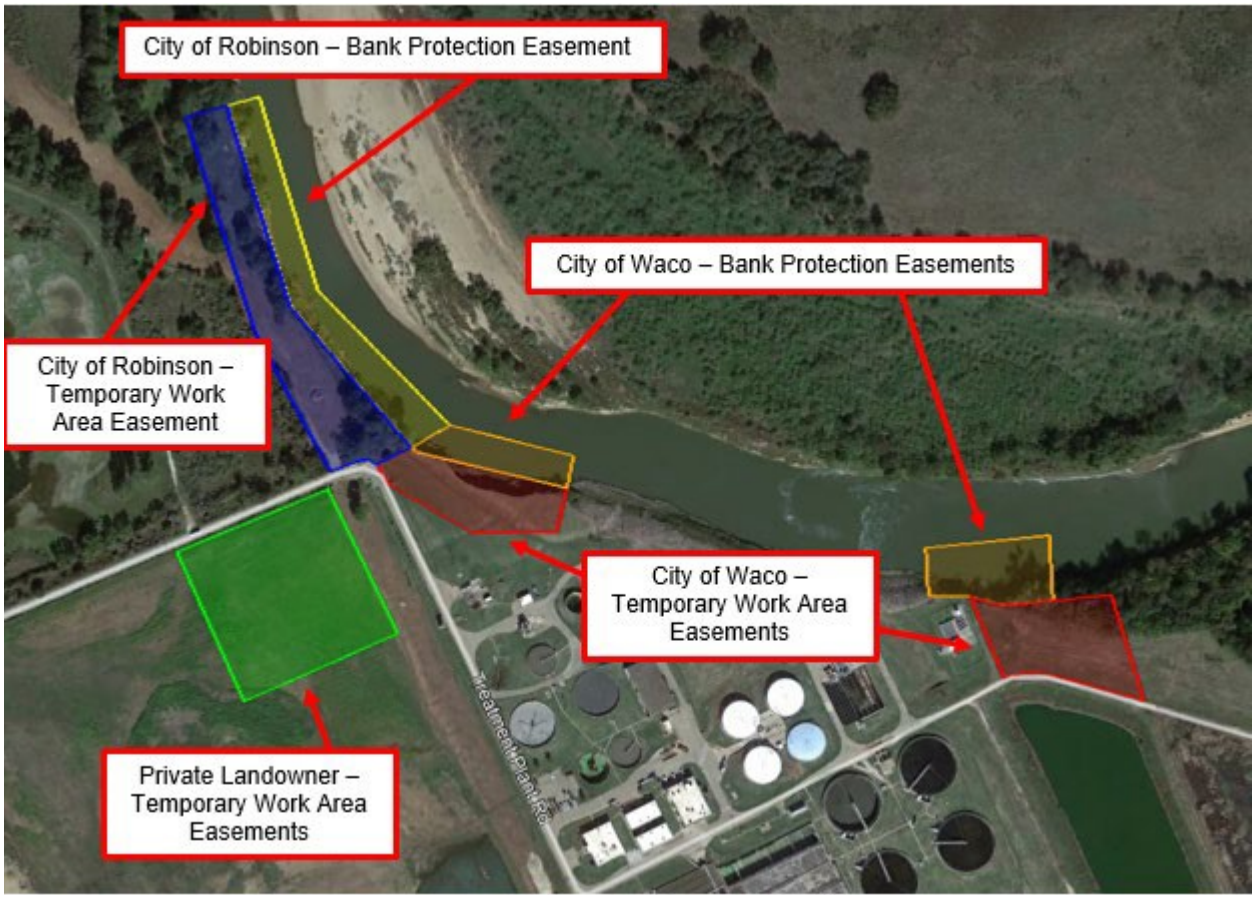

Figure 15. Tract Ownership of Project Site

12 Cost Estimate of Recommended Plan

Table 7. Recommended Plan Cost Estimate

Construction Item	Alternative 2
01 - Lands and Damages	$88,000
16 - Bank Stabilization	5,768,000
30 - Planning, Engineering, and Design	922,000
31 - Construction Management	520,000
Project First Cost	**$7,298,000**

13 Estimated Cost Apportionment

The Project Cooperation Agreement for the existing 2002 project specifies the total project costs as $1,422,300 with the sponsor's cost share specified as $497,900. The estimated first cost of the TSP is

$7,298,000 which would carry a sponsor cost share of $2,554,000. The combined cost of the existing project and the TSP is $8,720,000. Based on a 65/35 cost share split the Federal share would be $5,667,700. However, the program limit for Section 14 projects is $5,000,000. Therefore, the Non-Federal sponsor could responsible for an additional $667,700 above their 35 percent share of $3,052,300. Cost Share numbers for the existing project, the TSP, and the combined project are displayed in the following table.

Table 8. Estimated First Costs for Existing Project, TSP, and Combined Project

Existing Section 14 Project	
Federal Share	$924,000
Non-Federal Share	$498,000
Tentatively Selected Plan	
Federal Share	$4,743,700
Non-Federal Share	$2,554,300
Combined Project	
Federal Share	$5,667,700
Non-Federal Share	$3,052,300

14 Project Implementation

Once a letter of intent is received from the City of Waco, efforts would continue on the development of plans and specifications for the Recommended Plan. When the plans and specifications are sufficiently complete, project approval and a commitment of Federal funds for construction would be requested. Once received, the Project Partnership Agreement (PPA) would be executed, followed by advertisement of a construction contract. Table 5 below displays the major project milestones and their completion date.

Table 9. Project Implementation

Milestone	**Completion Date**
Initiate Plans and Specifications	15-Aug-22
Receive Project Approval	TBD
Execute PPA	5-Apr-22
Confirm NFS Real Estate Ownership	25-Aug-22
Real Estate Certification	25-Aug-22
Advertise Construction Contract	16-May-23
Award Contract	21-Jul-23

15 Obligation of the Parties

Federal implementation of the project will be subject to the execution of a binding PPA. The appropriate model PPA will be used unless a deviation is approved by the appropriate USACE authority. The current model PPA includes the terms in paragraphs A though J below; however, model terms are subject to change and the terms of any PPA will be governed by applicable Federal law, policy, and guidance at the time of execution.

A. In accordance with Federal laws, regulations, and policies, the Government shall undertake design and construction of the Project using funds appropriated by the Congress and funds provided by the Non-

Federal Sponsor.

B. The Non-Federal Sponsor shall contribute a minimum of 35 percent, up to a maximum of 50 percent, of construction costs, as follows:

1. The Non-Federal Sponsor shall pay 5 percent of construction costs.

2. In accordance with Article III, the Non-Federal Sponsor shall provide the real property interests, placement area improvements, and relocations required for construction, operation, and maintenance of the Project. If the Government determines that the Non-Federal Sponsor's estimated credits for real property interests, placement area improvements, and relocations will exceed 45 percent of construction costs, the Government, in its sole discretion, may acquire any of the remaining real property interests, construct any of the remaining placement area improvements, or perform any of the remaining relocations with the cost of such work included as a part of the Government's cost of construction. Nothing in this provision affects the Non-Federal Sponsor's responsibility under Article IV for the costs of any cleanup and response related thereto.

3. In providing in-kind contributions, if any, the Non-Federal Sponsor shall obtain all applicable licenses and permits necessary for such work. As functional portions of the work are completed, the Non-Federal Sponsor shall begin operation and maintenance of such work. Upon completion of the work, the Non-Federal Sponsor shall so notify the Government within 30 calendar days and provide the Government with a copy of as-built drawings for the work.

4. After determining the amount to meet the 5 percent required by paragraph B.1., above, for the then-current fiscal year and after considering the estimated amount of credit that will be afforded to the Non-Federal Sponsor pursuant to paragraphs B.2. and B.3., above, the Government shall determine the estimated additional amount of funds required from the Non-Federal Sponsor to meet its minimum 35 percent cost share for the then-current fiscal year. No later than 60 calendar days after receipt of notification from the Government, the Non-Federal Sponsor shall provide the full amount of such required funds to the Government in accordance with Article VI.

5. No later than August 1st prior to each subsequent fiscal year, the Government shall provide the Non-Federal Sponsor with a written estimate of the full amount of funds required from the Non-Federal Sponsor during that fiscal year to meet its cost share. Not later than September 1st prior to that fiscal year, the Non-Federal Sponsor shall provide the full amount of such required funds to the Government in accordance with Article VI.

C. To the extent practicable and in accordance with Federal law, regulations, and policies, the Government shall afford the Non-Federal Sponsor the opportunity to review and comment on solicitations for contracts, including relevant plans and specifications, prior to the Government's issuance of such solicitations; proposed contract modifications, including change orders; and contract claims prior to resolution thereof. Ultimately, the contents of solicitations, award of contracts, execution of contract modifications, and resolution of contract claims shall be exclusively within the control of the Government.

D. The Government, as it determines necessary, shall undertake actions associated with historic preservation, including, but not limited to, the identification and treatment of historic properties as those properties are defined in the National Historic Preservation Act (NHPA) of 1966, as amended. All costs incurred by the Government for such work (including the mitigation of adverse effects other than data recovery) shall be included in construction costs and shared in accordance with the provisions of this Agreement. If historic properties are discovered during construction and the effect(s) of construction are determined to be adverse, strategies shall be developed to avoid, minimize or mitigate these adverse effects. In accordance with 54 U.S.C. 312507, up to 1 percent of the total amount authorized to be appropriated for the Project may be applied toward data recovery of historic properties and such costs shall be borne entirely by the Government. In the event that costs associated with data recovery of historic properties exceed 1 percent of the total amount authorized to be appropriated for the Project, in accordance with 54 U.S.C. 312508, the Government will seek a waiver from the 1 percent limitation under 54 U.S.C. 312507 and upon

receiving the waiver, will proceed with data recovery at full federal expense. Nothing in this Agreement shall limit or otherwise prevent the Non-Federal Sponsor from voluntarily contributing costs associated with data recovery that exceed 1 percent.

E. When the District Commander determines that construction of the Project, or a functional portion thereof, is complete, within 30 calendar days of such determination, the District Commander shall so notify the Non-Federal Sponsor in writing and the Non-Federal Sponsor, at no cost to the Government, shall operate, maintain, repair, rehabilitate, and replace the Project, or such functional portion thereof. The Government shall furnish the Non-Federal Sponsor with an Operation, Maintenance, Repair, Rehabilitation, and Replacement Manual (hereinafter the "OMRR&R Manual") and copies of all as-built drawings for the completed work.

1. The Non-Federal Sponsor shall conduct its operation, maintenance, repair, rehabilitation, and replacement responsibilities in a manner compatible with the authorized purpose of the Project and in accordance with applicable Federal laws and specific directions prescribed by the Government in the OMRR&R Manual. The Government and the Non-Federal Sponsor shall consult on any subsequent updates or amendments to the OMRR&R Manual.

2. The Government may enter, at reasonable times and in a reasonable manner, upon real property interests that the Non-Federal Sponsor now or hereafter owns or controls to inspect the Project, and, if necessary, to undertake any work necessary to the functioning of the Project for its authorized purpose. If the Government determines that the Non-Federal Sponsor is failing to perform its obligations under this Agreement and the Non-Federal Sponsor does not correct such failures within a reasonable time after notification by the Government, the Government, at its sole discretion, may undertake any operation, maintenance, repair, rehabilitation, or replacement of the Project. No operation, maintenance, repair, rehabilitation, or replacement by the Government shall relieve the Non-Federal Sponsor of its obligations under this Agreement or preclude the Government from pursuing any other remedy at law or equity to ensure faithful performance of this Agreement.

F. The Non-Federal Sponsor shall not use Federal Program funds to meet any of its obligations under this Agreement unless the Federal agency providing the funds verifies in writing that the funds are authorized to be used for the Project. Federal program funds are those funds provided by a Federal agency, plus any non-Federal contribution required as a matching share.

G. In carrying out its obligations under this Agreement, the Non-Federal Sponsor shall comply with all the requirements of applicable Federal laws and implementing regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964 (P.L. 88-352), as amended (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto; the Age Discrimination Act of 1975 (42 U.S.C. 6102); and the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and Army Regulation 600-7 issued pursuant thereto.

H. In addition to the ongoing, regular discussions of the parties in the delivery of the Project, the Government and the Non-Federal Sponsor may establish a Project Coordination Team to discuss significant issues or actions. The Government's costs for participation on the Project Coordination Team shall not be included in construction costs that are cost shared but shall be included in calculating the Federal Participation Limit. The Non-Federal Sponsor's costs for participation on the Project Coordination Team shall not be included in construction costs that are cost shared and shall be paid solely by the Non-Federal Sponsor without reimbursement or credit by the Government.

I. Notwithstanding any other provision of this Agreement, the Non-Federal Sponsor shall be responsible for all costs in excess of the Federal Participation Limit.

J. The Non-Federal Sponsor may request in writing that the Government perform betterments on behalf of the Non-Federal Sponsor. Each request shall be subject to review and written approval by the Division Commander. If the Government agrees to such request, the Non-Federal Sponsor, in accordance with Article VI.F., must provide funds sufficient to cover the costs of such work in advance of the Government

performing the work.

16 Compliance with Environmental Laws

Endangered Species Act of 1973, as amended – Due to the fragmented nature of the area and ongoing impacts from heavy erosion, it is unlikely that the subject property would support any of the protected wildlife species for other than transitory purposes. Therefore, there are no anticipated adverse impacts on threatened or endangered species resulting from the proposed bank stabilization project.

Executive Order (EO) 13186 (Migratory Bird Habitat Protection) – Sections 3a and 3e of EO 13186 direct Federal agencies to evaluate the impacts of their actions on migratory birds, with emphasis on species of concern, and inform the U.S. Fish and Wildlife Service of potential negative impacts on migratory birds. The proposed bank stabilization would not result in adverse impacts on migratory birds or their habitats.

Migratory Bird Treaty Act – The Migratory Bird Treaty Act of 1918 extends Federal protection to migratory bird species. The nonregulated "take" of migratory birds is prohibited under this act in a manner similar to the prohibition of "take" of threatened and endangered species under the Endangered Species Act. The proposed bank stabilization project would not involve the clearing of trees or shrubs for access and would not result in adverse impacts on migratory birds or their habitats.

Clean Water Act (CWA) of 1972 – The Recommended Plan is in compliance with all state and Federal CWA regulations and requirements. Since this is an emergency streambank protection project, there would be no other practical alternatives to conducting proposed activities within the flood plain.

Section 404 (b)(1) of the Clean Water Act of 1972 requires that any recommended discharge of dredged or fill material into waters of the United States must be evaluated using the guidelines developed by the Administrator of the U.S. Environmental Protection Agency (EPA) in conjunction with the Secretary of the Army. These guidelines are located in Title 40, Part 230 of the Code of Federal Regulations. A Section 404 (b)(1) evaluation (Environmental Appendix) analyzes all activities associated with the Recommended Plan that involving the discharge of dredged or fill material into waters of the United States.

The 404(b)(1) report Section 404 of the Clean Water Act (CWA) will be submitted to the Texas Commission on Environmental Quality (TCEQ) for water quality certification under Section 401 of the CWA.

Section 402 of the Clean Water Act and Chapter 26 of the Texas Water code require construction activities that disturb areas greater than 1 acre to obtain a National Pollution Discharge Elimination System (NPDES) Construction General Permit. Bank stabilization construction operations would meet water quality standards set forth by Section 402 of the Clean Water Act and Chapter 26 of the Texas Water Code by preparing and following a Storm Water Pollution Plan (SWPPP) approved by the USACE and the Texas Commission of Environmental Quality (TCEQ). This SWPPP would outline measures for the contractor to implement during construction activities to minimize pollution in storm water runoff. A TCEQ Notice of Intent (NOI) would be filed at least 48 hours prior to any ground disturbing activities. As required a copy of this NOI and the prepared SWPPP would be posted on site.

National Historic Preservation Act (NHPA) of 1966, as amended – Please see the section/subsection of this document: ENVIRONMENTAL CONSEQUENCES/Cultural Resources, for additional information regarding compliance with the NHPA.

Clean Air Act of 1977 – Please see the section/subsection of this document: ENVIRONMENTAL CONSEQUENCES/Air Quality, for additional information regarding compliance with the Clean Air Act of 1977.

Farmland Protection Policy Act (FPPA) of 1980 and 1995 – The FPPA's purpose is to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses. There is no Prime Farmland within the project area.

EO 11990, Protection of Wetlands – EO 11990 requires Federal agencies to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in executing Federal projects. There are no wetlands within the project area and therefore the Recommended Plan is in compliance with EO 11990.

EOs Concerning Floodplain Management – EO 13690 was enacted on January 30, 2015 to amend EO 11988, enacted May 24, 1977, in furtherance of the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.), the National Flood Insurance Act of 1968, as amended (42 U.S.C. 4001 et seq.), and the Flood Disaster Protection Act of 1973 (Public Law 93-234, 87 Star.975). The purpose of the EO 11988 was to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative. EO 13690 builds on EO 11988 by adding climate change criteria into the analysis. However, EO 13690 was partially repealed by EO 13807, Presidential Executive Order on Establishing Discipline and Accountability in Environmental Review and Permitting Process for Infrastructure to increase infrastructure investment.

The EOs state that each agency shall provide and shall take action to reduce the risk of flood loss, to minimize the impacts of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for:

- Acquiring, managing, and disposing of federal lands and facilities;
- Providing federally undertaken, financed, or assisted construction and improvements; and
- Conducting federal activities and programs affecting land use, including, but not limited to water and related land resources planning, regulation, and licensing activities.

The project is consistent with the requirements found in the EOs described above. The recommended plan does not increase the base flood elevation.

EO 12898, Environmental Justice – Please see the section/subsection of this document: ENVIRONMENTAL CONSEQUENCES/Socioeconomic and Environmental Justice, for additional information regarding compliance with the Clean Air Act of 1977. The Recommended Plan follows EO 12898.

17 Conclusions and Recommendations

The right bank of the Brazos River, adjacent to the City of Waco WMARSS Treatment Plant, has continued to erode over a period of 19 years and is gradually encroaching the WMARSS Treatment Plant creating an untenable high-risk condition. Protection of the riverbank slope from further erosion landward is necessary to prevent failure of the stream bank and the loss of service of the WMARSS Treatment Plant. The recommended plan would provide riverbank protection against further erosion and save the affected facilities. This report along with the integrated EA discloses the potential environmental and cultural

impacts associated with the proposed emergency stream bank stabilization project along the Brazos River in the City of Waco, Texas.

The recommended plan, Alternative 2, Stone Riprap Toe Protection, would result in minimal temporary adverse impacts in the form of impacts to air and water quality. The stabilization would reduce stream bank erosion and subsequently improve local water quality by decreasing turbidity in the Brazos River caused by erosion and transport. The conclusion of this assessment that implementation of the recommended plan, the use of riprap would cause no significant environmental impacts and would not constitute a major Federal action requiring the preparation of an Environmental Impact Statement (EIS).

18 Report Preparers

The people who were primarily responsible for conducting the preparation of this Planning Design Report and Integrated Environmental Assessment are listed below.

Table 10. List of Report Preparers

Name	Discipline/Expertise
Zia Burns	Project Manager
Jodie Foster	Planning
Danny Allen	Environmental
Norm Lewis	Economist
Joseph Murphey	Cultural Resources
Landis Grimmett	Civil Engineering
Mike Danella, P.E.	H&H Engineering
Karl Pankaskie	Cost Engineering
Eugenia Barnes	HTRW
Tony Mendolia	Real Estate
Randy Merchant	Office of Counsel
R.C. Kannan	Geotechnical Engineering

19 References

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