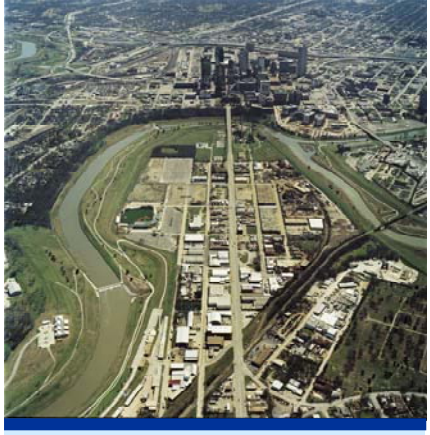
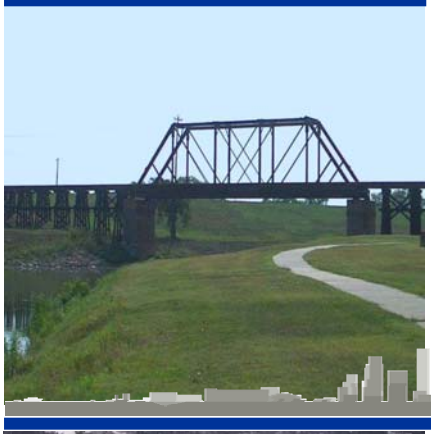
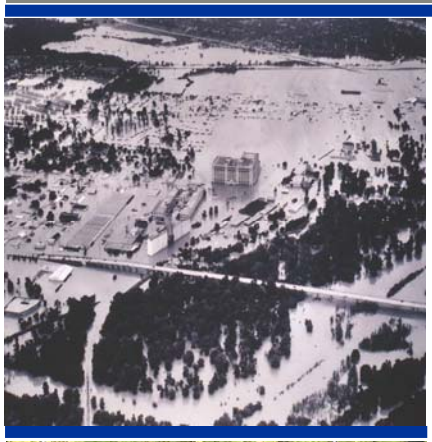




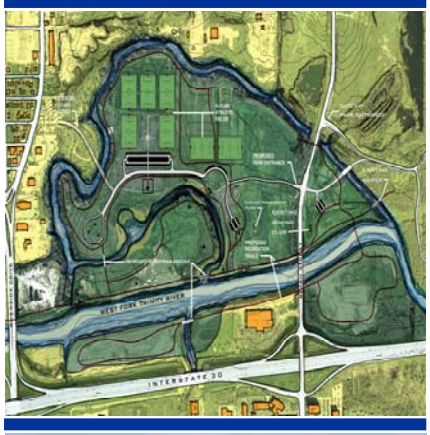
Fort Worth Central City Preliminary Design

404(B)(1) Analysis



Final Supplement No. 1 to the Final Environmental Impact Statement

Appendix F



March 2008

Rendering Image courtesy of CDM

Section 404 (b) (1) Analysis

Fort Worth Central City

Modified Central City Project

1.0 Project Description

1.1 Authority and Purpose

Corps participation in the Central City Project was authorized by Section 116 of the Consolidated Appropriations Act, 2005 which directed the Corps to undertake the Central City project as generally described in the Trinity River Vision Master Plan and authorizes the Corps participation at a total cost not to exceed $220,000,000. Section 116 further establishes that the Corps share of that project will be $110,000,000. The Trinity River Vision Master Plan's goals for the Central City project were: develop the river as an aesthetic and recreational focal point for Central City redevelopment; provide for a higher density of people living, working, playing and learning; orient mixed use development on the river; develop an urban lake; provide higher constant water level; eliminate levees where possible; continue trails through downtown consistent with the overall Trinity River Master Plan; improve water quality and wildlife habitat; and provide linkages to neighborhoods and districts. These goals should be accomplished while restoring the design level of flood protection to the Central City area and improving interior drainage.

Discharge of fill material into "waters of the United States" including wetlands associated with the project require compliance with Section 404 of the Clean Water Act. This Section 404(b) (1) analysis is one step in that compliance. Future project authorizations could change the level of Corps participation; however, if level of participation by the Corps is subsequently increased and it is still within the scope of the Central City project evaluated in this document, no further analysis under Section 404 would be necessary.

1.2 Background

A Final Environmental Impact Statement (FEIS) was completed for the original Central City Project in January 2006 and the Central City Project Report was completed in March 2006. The Record of Decision (ROD) was signed, and the Project Report recommending the Central City Community-Based Alternative was found to be technically sound and environmentally acceptable, by the Assistant Secretary of the Army (ASA (CW)) on 7 April 2006.

By letter dated 22 June 2006, the City of Fort Worth requested that the Corps of Engineers conduct an evaluation to consider the potential benefits of modifying the original Central City Project to incorporate the Riverside Oxbow Ecosystem Restoration Project. The City's request recognized that each of these projects are moving forward as individual projects and that they are located adjacent to one another. The City and the Tarrant Regional Water District, the non-Federal sponsor for these two projects, indicated their opinion that based on their adjacency, there might be merit in merging the two projects. In their letter, the City of Fort Worth identified potential benefits of combining the projects that would not be achieved if they were to continue to proceed as individual projects. In response to the City's letter request, the Fort Worth District Corps of Engineers performed an initial evaluation which suggested that the concept merited detailed study. The result of those detailed evaluations is presented in Supplement No. 1 to the Final EIS for the Central City Project.

Based upon detailed evaluations presented in Supplement No. 1 to the Final EIS for the Central City Project, and prior to public coordination under the National Environmental Policy Act, The Fort Worth District has selected the Modified Central City alternative for recommendation. The major difference between the Modified and

original Central City alternatives is in location of valley storage sites required to accommodate the increased hydraulic efficiency of the bypass channel, a primary component of the Central City Project, relocation of Samuels Avenue Dam, and the incorporation of many features of the Riverside Oxbow Project. The Modified alternative retains the major physical features of the original Central City Project but utilizes existing public lands to a greater extent and minimizes use of private lands to accommodate the valley storage requirement.

1.3 Location and General Description

The Central City project, described as the Community Based Alternative in Chapter 3 of the FEIS as modified by Supplement No.1 to the Final Environmental Impact Statement (SEIS) would be located on the Clear and West Forks of the Trinity River in Fort Worth, Tarrant County Texas. This comprehensive project would incorporate a bypass channel, a levee system, and associated improvements to divert flood flows around a segment of the existing Trinity River adjacent to downtown Fort Worth. The specific components of this modified plan are discussed in Chapter 3 of the SEIS.

The project also includes hydraulic mitigation to comply with valley storage requirements. The hydraulic mitigation would be accomplished at six locations including the Rockwood West, University Drive, downstream sites in the vicinity of Samuels Avenue, Riverside Park, Ham Branch, and Riverside/Gateway Park. An in-channel dam, on the West Fork, just upstream of Marine Creek would impound water to a normal water surface elevation of approximately 525 feet NGVD. A low water dam is proposed on Marine Creek to establish a pool elevation of approximately 516.5 NGVD and lock structure located at the dam will provide water connectivity between pools. In addition, the Riverside/Gateway Park mitigation site would be ecologically restored to re-establish the biological integrity by reconnecting the severed channel and restoring riparian woodlands, emergent wetlands, and native grasslands. Two oxbows within the Rockwood Park area would be reconnected to the West Fork providing improved aquatic habitat to the system. Mitigation for stream habitat losses due to inundation of portions of Marine Creek will be accomplished by stream habitat development within Ham Branch and in the Sycamore Creek Oxbow previously severed from the Trinity River. The components of the Modified Central City Project are shown on **Figure 1**.

1.4 Alternatives Considered

Section 404(b) (1) guidelines of the Clean Water Act requires that "except as provided under section 404(b) (2), no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences." The guidelines consider an alternative practicable "if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes."

The Central City FEIS reviewed and evaluated the following alternatives: No Action Alternative, Principles and Guidelines Based Alternative (P&G alternative), and Community Based Alternative. Within the P&G, and Community Based Alternative, alternative locations, configurations, and size of the bypass channel, valley storage, interior water feature, and isolation gates were analyzed as discussed in Chapter 3 of the FEIS. The Recommended Plan's alignment and location of these specific features within the river corridor was based on technical studies, such as Hydrology and Hydraulic, and Geotechnical Investigations that provided in-depth consideration of logistics and functionality. Combining the Central City Project valley storage requirements and the Riverside Oxbow Project was not evaluated at that time because the Riverside Oxbow Project had been recommended for authorization and the study team believed that authorization was imminent.

Neither the No Action Alternative nor the P&G Alternative fulfilled the overall project purposes and goals of the authorized Central City project as described in the Trinity River Vision Master Plan. Therefore, they are not considered "practicable" alternatives under the 404 (b) (1) guidelines and it was determined that the Community Based Alternative as recommended by the FEIS was the least damaging practicable alternative. This plan

substantially fulfilled the overall project goals described in the Trinity River Vision Master Plan (April 2005).

The Riverside Oxbow Ecosystem Restoration study area encompassed approximately 1060 acres and is located just east of downtown Fort Worth, on the West Fork of the Trinity River. The study area's river reach lies downstream of Riverside Drive (the downstream end of the Fort Worth Floodway project) and extends to a point coinciding with the East 1st Street Bridge crossing of the West Fork. The reach includes the old West Fork channel, which formed an oxbow when the channel was realigned several decades ago, the West Fork and Sycamore Creek confluence, and a low water dam downstream of Beach Street.

Several alternative plans were formulated during the Riverside Oxbow Ecosystem Restoration study that led to the identification of the National Ecosystem Restoration (NER) Plan. In addition a "No Action" alternative and a Locally Preferred Plan (LPP) were carried to the final array of alternatives. The NER plan, as modified by addendum dated April 2005 was approved by the Secretary of Army. The approved plan consists of reestablishing low flows through the old severed West Fork of the Trinity River oxbow including replacing the existing Beach Street Bridge; creation of emergent wetlands, open water, and vegetative fringe habitat; habitat improvement of existing forested tracts, including establishment of a riparian buffer along the West Fork from Riverside Drive to East 1st Street. Additional features of the plan include reforestation of land using a variety of native hard and soft mast trees and shrubs; new park entrance, replacing the Beach Street Bridge, preservation and habitat improvements of native prairie and scrub/shrub uplands (see figure 2 of the SEIS for details of the approved Riverside Oxbow project features).

Additionally, alternatives were evaluated during the evaluation and analysis to merge the Central City Project with features of the Riverside Oxbow Project. This analysis in the SEIS includes the evaluations of the Technical and Environmental acceptability of modifying the Central City Project to incorporate features of the Riverside Oxbow Project in terms of hydraulic efficiency, valley storage, increased opportunity for riparian, aquatic and wetlands restoration, more comprehensive and synergistic development of recreation opportunities and implementation.

The project would result in a loss of floodplain or valley storage due to the fact that the bypass channel is shorter and more efficient than the existing river channel. Without mitigation, as much as 5,250 acre feet of valley storage could be lost. A number of alternative valley storage sites were considered and evaluated to provide hydraulic mitigation as discussed in Chapter 3 of the FEIS. Additional alternatives and sites were further considered and evaluated during this SEIS process. The supplemental evaluation includes a review of environmentally sensitive areas, minimization of adverse impacts and hydraulic suitability. Chapter 3, formulation in the SEIS discusses the evaluation of storage mitigation and explains the rationale for determining the recommended sites. The compensatory mitigation would off-set this potential loss of storage by creating valley storage mitigation sites along the West Fork of the Trinity River upstream of the project area, in the vicinity of Rockwood Park and University Drive, and slightly downstream of the dam in the proximity to Samuels Avenue, Riverside Park and the Riverside/Gateway Park site. These recommended locations were determined to be the least environmentally damaging practicable alternative for hydraulic mitigation. In addition, the Riverside/Gateway Park site also provides the opportunity to develop habitat in an existing floodplain area which includes the original West Fork and Sycamore Creek Oxbow channels. The Corps participation is a subset of the Community Based Alternative and is part of the least environmentally damaging practicable alternative.

A number of alternative locations for the Samuels Avenue Dam were considered and evaluated as discussed in Chapter 3 of the FEIS and in Chapter 3 of the SEIS. A location just downstream of Marine and Lebow Creeks near Samuels Avenue was determined in the Central City FEIS to be necessary in order to meet the goal of raising the Trinity River water level and within Marine Creek to provide a water linkage among neighborhoods, businesses, and cultural amenities of the Central City area. The SEIS re-evaluated this location based upon geotechnical concerns and an effort to reduce impacts to stream and aquatic habitat. The evaluation resulted in a

revised location just upstream of the confluence with Marine Creek. The selected site maintains the pool elevation of 525 NGVD while simplifying the operation of the dam, eliminates the adverse impacts to Lebow Creek, and reduces backwater impacts to Marine Creek.

In association with the proposed new site just upstream of the Marine Creek confluence on the West Fork of the Trinity River and configuration for the Samuels Avenue Dam, a fixed low water dam is proposed on Marine Creek at the confluence with the West Fork of the Trinity River to meet project objectives of navigability and connectivity to the Stockyards area. Several alternatives were evaluated for the Marine Creek low water dam including the use of a gated or fixed structure as well as varying the crest width and height. A fixed structure is recommended on Marine Creek since this alternative is able to meet the design requirements of not increasing existing 100-year water surface elevations on Marine Creek while also minimizing construction, operation, and maintenance costs. The proposed crest elevation of the low water dam is 516.5 NGVD which reduces adverse impacts on Marine Creek upstream from the main river as compared to the elevation of 525 NGVD that would have occurred with implementation of the Samuels Avenue Dam at the location identified within the FEIS.

The Modified Central City Project addresses all of the project objectives contained in the Trinity River Vision Master Plan referenced in the Authorization which satisfy the four overall project purposes, i.e. Flood Damage Reduction, Ecosystem Improvements, Urban Revitalization and Recreation. It provides the design level of protection within the system, and improves the performance of the interior drainage components, reducing the 100-year floodplain in sumps 16W, 24C, 25C, and 26 by 180 acres.

A complete description of the Modified Central City alternative is included in Chapter 3, of the SEIS. Other actions would potentially occur in the future in conjunction with the ultimate development of the Trinity Uptown Features. Some of these activities could impact waters of the United States. These future actions are not being considered during this analysis other than for potential cumulative impacts. Future actions within the area by others would require consideration for compliance with Section 404 of the Clean Water Act at the time they are proposed.

1.5 General Description of Fill Material

The comprehensive Modified Central City project consists of four primary construction areas: the University Drive Hydraulic Mitigation Site; the Bypass Channel Area with associated Interior Water Feature and isolation gates; Samuels Avenue and Marine Creek Dams; and the Hydraulic Mitigation Sites. **Figure 2** denotes the delineation of waters of the United States from the National Hydrographic Dataset products, publication date 2005. Construction of improvements where excavation and or fill are located within the Ordinary High Water Mark (OHWM) of waters of the United States will include the three isolation gates and pedestrian bridges, Samuels Avenue and Marine Creek Dams, ecosystem mitigation and restoration of the West Fork and Sycamore Creek Oxbows, and tie-ins of the Bypass Channel to the existing Trinity River Channel. These locations are shown on **Figure 3**.

An initial geotechnical investigation consisting of a review of existing geotechnical and geologic data and geotechnical exploration was performed to determine general excavation/ fill material characteristics. The fill characteristics within the specific areas identified during the investigation found in general alluvial soils consisting primarily of clay with terraces of sand and gravels overlying generally fresh, unweathered limestone bedrock. The following discussion is applicable to both the overall Modified Central City comprehensive project and the Corps participation unless otherwise noted.

1.5.1 Fill Material Characteristics

A review of existing geologic data for the project area found that the geologic history of the area is complex. During the Triassic and Jurassic periods, withdrawal of the seas from north central Texas along with subsidence of the Gulf Coast Embayment reversed the direction of drainage. The variation of sea levels during the

Cretaceous period generally resulted in multiple layers of geologic deposits. Depositions include members of the Fredericksburg Group which are exposed in the project area and provide the primary geologic formation for construction of the project. This includes the Goodland Limestone, the Kiamichi Formation, the Washita Group, the Duck Creek Formation and the Fort Worth Formation.

Much of the project area is covered with alluvium and terrace materials of Quaternary Age. Bottom-land gravels have formed terraces or benches closer to the stream valleys. These terraces become more distinct as proximity to the current stream channels gets closer. The lowermost terrace is the present floodplain and includes alluvium a few feet above the present stream bed. The alluvial deposits were derived from formations that outcrop within the drainage basin, and range in thickness from a feather-edge to approximately 45 feet. The upland gravels in the area consist of angular gravels, clay and silt. The sand and gravel are mostly poorly sorted fragments of platy limestone. The lower terrace and floodplain deposits consist of rounded gravel, sand and clay. These deposits are generally well sorted and not well cemented.

Preliminary geotechnical investigations have been performed during the initial project Feasibility Studies for both the authorized original Central City and the Riverside/Oxbow Projects. Further investigations will be conducted during the design stage to develop final design parameters and to further define conditions within the combined project area, including the various valley storage mitigation sites, the low water dam at Marine Creek, and an alternate location for the Samuels Avenue Dam and Lock. A discussion of these investigations and results is presented in Appendix B Geotechnical to the SEIS.

The initial geotechnical exploration along the proposed bypass channel and Samuels Avenue Dam site revealed alluvial soils overlying bedrock. The alluvial soils consisted primarily of clay with lenses and layers of sand and gravel and overlying generally unweathered limestone bedrock. This area is within the scope of the Corps participation.

The majority of the clay can be described as having a medium potential for volume change, which is defined as clay with a Plasticity Index ranging from 15 to 28 percent and a Liquid Limit ranging from 35 to 50 percent. The results of permeability tests performed on the clay samples show permeability values are generally low and indicate that the soils are capable of water containment within the proposed bypass channel and levees. The area of the proposed bypass channel is within the scope of the Corps participation.

Seams of sand and gravel overburden soils were found to occur primarily beneath the clay and directly over the limestone bedrock. There was no significant correlation between percent fines, sands, and gravels with depth. Limestone with shale seams was encountered in borings above the proposed lower bypass channel bottom, indicating that some rock excavation would be necessary during construction of the bypass channel, which may then be used as fill elsewhere on the project. The limestone was found to be generally fresh and unweathered, and can be classified as moderately hard. This area is within the scope of the Corps participation level.

Results from site specific geotechnical explorations have not been received from each of the individual valley storage mitigation sites. However, based on previous investigations by the USACE during the Riverside Oxbow Interim Feasibility Study and other studies in the project area, including investigations conducted as part of the closure of the old Riverside Waste Water Treatment Plant; the overburden appears to be clay and claying sands with significant lenses of sand and gravel. The geological deposits in the remaining areas are thought to be similar to that found in the areas investigated. The findings from the initial geotechnical investigations are included in Appendix B of the SEIS.

1.5.2 Fill Classification

Fill operations for the comprehensive Modified Central City Project have been segregated into two classifications based on nature of the operation, proximity of the fill to the existing riverine system and elevation. The nature of each classification is described below and the location of each classification is shown

on **Figure 3** and **Figure 4**. These classifications are applicable to both the overall comprehensive plan and the Corps participation unless otherwise noted.

> ***Cut/Fill within the OHWM***– Material (construction activity) that is placed (occurs) below the Ordinary High Water Mark (OHWM) within the existing riverine sites.
>
> ***Cut/Fill outside the OHWM*** – Material (construction activity) which is placed (occurs) outside of the existing riverine system and OHWM which may have the potential to impact waters of the U.S.

1.5.3 Fill Quantities

Approximately 640,020 cubic yards of material are anticipated to be excavated and/or discharged (filled) as part of the Central City Project within waters of the United States below the OHWM. Of this quantity the estimated fill within the OHWM is approximately 422,605 cubic yards and the estimated excavation quantity is approximately 219,415 cubic yards. The majority of this fill material will form permanent control structures that will be placed within the waterway and the precise amount is dependent on final design.

The material excavated for this project is intended to be used for other project related activities and it is not expected that any excess material from the project would be transported outside of the project area. Contaminated material, if encountered, that is not suitable for placement within the project area would be disposed of at an appropriate licensed landfill facility. Contamination determination is discussed in Section 2.4 of this document.

1.5.4 Source of Fill Material

The fill material for the Modified Central City Project would be generated from excavation activities associated with the project or from the placement of concrete structures within the waterway. Sources would be the same for both the overall comprehensive Modified Central City Plan and the Corps participation. The primary sources of fill material would be from the excavation of the Corps portion of the overall project as follows: construction of the Marine Creek Low Water Dam, Samuels Avenue Dam, the Trinity Point Isolation Gate, the TRWD Isolation Gate and storm water pump station, the Clear Fork Isolation Gate, Interior Water Feature, Ham Branch Mitigation, West Fork (Rockwood) Ecosystem Restoration, Upper Bypass Channel tie-ins to the Clear Fork and West Fork of the Trinity River, the Lower Bypass Channel tie-ins to the West Fork of the Trinity River, Restoration of the old West Fork Riverside Oxbow and Ecosystem Mitigation of the old Sycamore Creek Oxbow.

Preliminary earthwork volume calculations for the currently proposed bypass channel tie-ins, dam construction, new isolation gates and valley storage mitigation sites are summarized in **Table 1**.

Table 1: Approximate Fill/Cut Quantities Within the OHWM.

Description	Fill Cubic Yards	Excavation (Removal) Cubic Yards
Bypass Channel Tie-Ins & Isolation Gates		
Upper Bypass Channel Tie-ins	18,655	10,340
Lower Bypass Channel Tie-ins	0	13,800
Clear Fork Isolation Gate	79,825	1,975
Trinity Point Isolation Gate	22,180	4,620
TRWD Isolation Gate & SWPS	121,900	3,900
Dam Sites		
Samuels Avenue Dam	15,065	22,890
Marine Creek Low Water Dam	4,875	9,485
Marine Creek Channel Improvement	0	1,500
Interior Water Feature		
Interior Water Feature and Pedestrian Bridges	160,105	36,940
Aquatic Mitigation/Restoration Sites		
Rockwood Park Ecosystem Restoration	0	50,000
Ham Branch Aquatic Mitigation	180	5,150
Riverside Oxbow Ecosystem Development	220	13,500
Sycamore Creek Aquatic Ecosystem Development	120	670
Valley Storage Sites		
Rockwood Park West	0	27,100
Samuels Avenue Sites	0	8,540
Riverside Park	0	655
Riverside Oxbow & Beach Street Bridge	0	8,350

1.5.4.1 Bypass Channel Tie-Ins & Isolation Gates

Construction for the Bypass Channel and isolation gates would be done to meet project goals of flood control while providing a catalyst for economic expansion into the area adjacent to downtown Fort Worth and to provide a linkage to the existing Stockyards area. The existing site is primarily urban with a mixture of industrial and commercial sites. Minimal terrestrial or wetland habitat value exists in this area because of the existing level of urban disturbances.

The majority of excavation and fill operations associated with the construction of the Bypass Channel would occur outside of the waters of the United States prior to the full use of the Bypass Channel to convey floodwaters. However, the tie-in of the New Bypass Channel to the existing Clear Fork and West Fork will require excavation within OHWM. This work will include removal of material from the OHWM, overbank and levee section to connect the New Bypass Channel to the main channel. This excavated material will be discharged to upland sites not immediately adjacent to waterways, proper management practices will be used i.e. silt fences, interceptor swales, sediment traps, etc. to prevent and control soil erosion, sedimentation, or discharge of materials to receivable waters.

The three isolation gates will be constructed adjacent to the Bypass Channel on the existing River Channel to provide flood protection during major storm events. Portions of the existing channel will be excavated and concrete gate structures constructed. Precise sequencing of excavation and fill activities, including location and size of temporary coffer dams and sheet pilings, would occur as a part of final design. The structures associated with the three isolation gates will result in approximately 223,905 cubic yards of permanent fill. This portion of the comprehensive plan is part of the Corps participation. Temporary coffer dams or sheet pilings are anticipated near each of the three proposed isolation gates (Clear Fork Gate, Trinity Point Gate, and TRWD Gate). Preliminary estimates anticipate approximately 50,000 cubic yards of temporary fill, from on-site sources, will be required for this purpose. This temporary fill is an impact of the Corps participation.

1.5.4.2 Dam Sites

The Samuels Avenue Dam and Marine Creek Low Water Dam structures located upstream of Samuels Avenue would result in approximately 19,940 cubic yards of permanent material being placed into the West Fork of the Trinity River and Marine Creek and approximately 33,875 cubic yards of excavation and removal. In addition, Samuels Avenue Dam would impound water to an elevation of 525 feet NGVD during normal flow situations. At the Samuels Avenue Dam location, the existing normal water surface elevation (also considered to be the ordinary high water mark) is approximately 500 feet NGVD. Coupled with the development of the bypass channel and the Interior water feature, there would be a combined increase in water surface area of approximately 120 acres at normal flow conditions resulting from the project.

Precise sequencing of excavation and fill activities, including location and size of sheet piling would occur as a part of final design. In addition, deepening of the Marine Creek Channel is required for approximately 160 ft in length just upstream of 23rd Street.

All disturbed sites associated with excavation and discharge of fill materials would be protected during construction by appropriate erosion control practices including silt fences, interceptor swales, sediment traps. Prior to the removal of the erosion control practice all exposed areas would be vegetated or otherwise mechanically stabilized. These impacts are considered within the scope of the Corps participation.

1.5.4.3 Interior Water Feature

This feature is associated with the overall comprehensive plan but the fill would not be included in the Corps participation. As a result of this fill the channel depth within the Interior Water Feature would vary between 10 and 15 feet. The earthwork-related fill associated with the interior water feature of the Modified Central City Plan is necessary to maximize recreational and aesthetic uses of this water feature. Thus the 160,105 cubic yards of permanent fill is reviewed both comprehensively and clarified as impacts of the Corps participation based on the fill associated with the interior water feature and the isolation gates.

1.5.4.4 Aquatic Mitigation and Restoration Sites

Excavation and removal of deposits and sedimentation will be required for the improvement of aquatic habitat at the Rockwood Park, Ham Branch, Riverside Oxbow and Sycamore Creek sites. These areas with exception of Ham Branch, currently have limited connectivity to the main water course; however, care will be taken during the design process to define measures and construction sequence. Approximately 69,320 cubic yards of material and sediments will be removed from these areas. Locations which are dry or have intermittent water supply will be excavated in sequence so that activities within the OHWM are minimized. Temporary bulkheads and dams will be used to isolate excavated areas until major activities are complete.

1.5.4.5 Valley Storage Sites

The sites selected for valley storage are generally overbank areas which are out of the main channel and riverine. These sites will be excavated to provide the additional valley storage required for the 100 yr and SPF flood events. However some grading and earthwork will be required for site drainage on the channel bank near the waterline and within the OHWM. Approximately 44,645 cubic yards of material will be removed from this overbank area within the OHWM. Proper controls and management practices will be used i.e. silt fences, interceptor swales, sediment traps, etc. to prevent and control soil erosion, sedimentation, or discharge of materials to receivable waters while they are being re-vegetated.

1.6 Cut/Fill Outside the OHWM

The Modified Central City Project also includes a number of related construction activities which have the potential to impact receivable waters. These activities include excavation of Valley Storage Sites outside the OHWM but within the 100 year floodplain, raising University Drive out of the 100 year flood elevation, levee

tie-ins to the new channel, overbank excavation, pedestrian bridges, and disposal of excavated materials at upland locations, landfill sites outside of the OHWM, 100 year and SPF limits. These are summarized on **Table 2** and shown on **Figure 4**.

Table 2: Approximate Cut/Fill Quantities Outside the OHWM.

Description	Excavation - Cubic Yards	Disposal - Cubic Yards
Valley Storage Sites		
Rockwood West	120,900	0
Samuels Avenue Sites	858,460	0
Riverside Park	301,345	0
Ham Branch	3,300	19,300
Riverside Oxbow	2,206,825	0
Gateway Park	860,000	0
University Drive		
University Drive	0	130,000
Interior Water Feature		
Interior Water Feature and Pedestrian Bridges	398,145	685
Upland Disposal Sites		
Brennan Avenue Landfill	0	663,000
Abandoned Impound Lot	0	490,000
Abandoned Eastside Landfill	0	1,138,000
Abandoned Eastside WWTP	0	1,515,000
North Gateway	0	426,000
Other Upland	0	17,200
Tie-ins, Gates and Structures		
Upper Bypass Channel Tie-ins	125,000	0
Lower Bypass Channel Tie-ins	77,920	85,925
Clear Fork Isolation Gate	0	117,500
Trinity Point Isolation Gate	12,800	28,775
TRWD Isolation Gate & SWPS	30,985	331,400
Samuels Avenue Dam	78,115	26,780
Marine Creek Low Water Dam	31,685	3,600
Pedestrian & Beach Street Bridges	1,320	955

1.6.1 Valley Storage Mitigation Sites

Valley Storage Mitigation will be provided by excavation of areas adjacent to the river but outside of the OHWM. There are five (5) general locations where Valley Storage Hydraulic Mitigation will occur by excavation. These are described in the SEIS and summarized as follows:

Rockwood Park West is a 23 acre site, publicly owned (City of Fort Worth); within the existing Trinity River floodplain on the southwestern portion of the existing Rockwood Park Golf Course. The site is bounded by the Trinity River on the east and existing federal levee to the west. Currently the site contains several golf course holes which would be eliminated as part of the city's plan to scale down the course. Vegetative cover on the site is primarily grassland with minimal tree coverage. Tree coverage to north and south of the site are to be preserved. The proposed work includes grading the site to gently slope towards the river to a bank elevation approximately 2 ft. above the proposed normal pool. Excavated materials will be transported and disposed of off-site.

The Samuels Avenue sites cover approximately 40 acres of public property within the Trinity River floodplain and are located downstream of the Samuels Avenue Bridge. The sites lie along the north and south banks of the West Fork Trinity River. The sites are bounded by Brennen Avenue to the north, Northside Drive to the east and south, and the Union Pacific Railroad right-of-way to the west. Vegetative cover on the site is primarily grassland. Proposed work includes grading the sites to gently slope towards the river to a bank elevation

approximately 1 ft. above the static water elevation controlled by the 4th Street low water dam. Excavated materials from the sites will be disposed of in the adjacent City impound lot and Brennen Avenue landfills.

The Riverside Park site is a 20 acre, publicly owned (City of Fort Worth) property located on the east bank of the West Fork Trinity within the Trinity River floodplain. The site is located immediately north of E. Belknap street and is bounded by the Oakhurst Scenic Drive on the east. The north side of the site is defined by an area of large old growth trees which are to be preserved. Vegetative cover on the site is mainly mowed grass. Proposed work includes grading the site to elevations ranging approximately between 3 ft. and 9 ft. above the static water level of 501 NGVD. Excavated materials will be transported and disposed of off-site to the landfill sites.

The Riverside Oxbow Sites are located immediately north of Interstate 30 and bounded by Beach Street on the east and Riverside Drive on the west consisting of approximately 200 acres entirely within the existing floodplain. The site is primarily encompassed within the current river channel and the old West Fork River Oxbow; however portions of the site extend to the north for ecosystem restoration purposes. The Riverside Oxbow Valley Storage Site also includes some property on the south bank near Sycamore Creek. Much of the Oxbow area is in tall grass with a number of scattered mature trees, mostly pecan. The old River Oxbow Channel is lined by dense riparian vegetation consisting of mature trees. A secondary Oxbow from Sycamore Creek also runs through the interior of the site. The site will be excavated from the two year flood elevation to just over the five year. Proposed recreational features include soccer fields, basketball courts, splash park and picnic areas.

The Gateway Park sites are located east of the Riverside Oxbow. The approximately 225 acres are bounded by Beach Street on the west, East 1st Street on the north, Trinity River on the east and I-30 to the south. Northeast and eastern portions of the site are characterized by fairly dense and mature riparian woodlands while the central and southern portions of the site are predominantly park and athletic facilities. The northwest portion of the site is largely vacant land with some commercial development along Beach Street. Proposed work includes grading the sites to elevations ranging from 5-year to less than 2-year frequency event flood elevations to maximize Valley Storage benefits. Ecosystem restoration will include riparian woodlands, emergent wetlands, and buffer, and native grassland. Existing woodland vegetation near the Gateway Park drive, along the Trinity River, and northeastern portions of the site would be preserved and enhanced as part of the ecosystem restoration. Portions of the excavated material from this site will need to be disposed of off-site at the abandoned Eastside Landfill. The site also contains an abandoned wastewater treatment plant site which is proposed for disposal of the excavated materials to minimize transport.

In addition five contingency Valley Storage sites have been identified which could be used to supplement the primary Valley Storage sites if it is found that additional valley storage is required. These sites are discussed in Chapter 3 of the SEIS and are located outside of the OHWM. Therefore there would be no change in the fill/cut quantities within the OHWM if any of these contingency sites are required.

1.6.2 University Drive Hydraulic Mitigation Site

University Drive crosses the West Fork and is located upstream and to the west of the proposed bypass channel. The site is an existing roadway with several commercial businesses located to the east. The site is within the 100-yr and SPF floodplain. Minimal habitat exists in this area because of the urban environment. The site is approximately 10 acres of roadway right-of-way. University Drive Mitigation consists of raising the roadway with excavated material within the 100-yr floodplain and is a key component in mitigating the loss of floodplain or valley storage. Site work would include raising the existing roadway profile out of the 100 year floodplain.

Construction of the University Drive embankment would occur outside the OHWM but within the 100-yr and SPF floodplain. Disturbed sites including areas of fill would be protected with appropriate erosion control practices. Prior to the removal of the erosion control practice all exposed areas would be vegetated and

stabilized. This site is within the scope of the Corps participation.

1.6.3 Upland Disposal Sites

The disposal of excavated fill material would be primarily by cut and fill operations using bulk scrapers. Additional materials would be transported by haul truck from the point of excavation to the designated disposal site when scrapers are infeasible or uneconomical based on haul distances. Excavated material would be sorted and handled on site prior to placement in the designated disposal area. Excavated material would be placed in suitable lifts and compacted as required for structural and soil stability design criteria. Excavated materials from the Valley Storage and Ecosystem Restoration Sites will be taken to sites out of the Riverine Environment and out of the 100 year and SPF floodplain limits. The sites include the old Brennen Avenue Landfills, the City's Impoundment Lot, property on the North Gateway site, the old abandoned wastewater treatment facility, and the closed Eastside Landfill. Separate erosion and run-off control plans will be prepared for the various construction contracts specific to each disposal site. The plans will include requirements for buffer zones, sedimentation basins, silt fences and interceptor trenches.

1.6.4 Bypass Channel Tie-Ins, Isolation Gates, and Dams

The tie-in of the new Bypass Channel to the existing Clear Fork and West Fork consisting of levees and high retaining walls, and construction of the isolation gates will occur outside of the OHWM. This excavation and fill operations associated with the construction of the Bypass Channel tie-ins, and isolation gates will include placing suitable fill for new levees and retaining wall outside the OHWM, and to connect the levee and hard edge sections of the new Bypass Channel to the main channel. Excavated material will be used to construct the new levees and as back fill behind the new retaining walls and isolation gate structures. Similarly construction of the Samuels Avenue and Marine Creek Dams will require excavation for the construction of training walls and fills outside of the OHWM. Excess excavated material from these sites, not required for backfill, will be hauled for disposal at one of the designated disposal sites. All disturbed sites would be protected during construction by appropriate erosion control measures i.e. silt fences, interceptor swales, and sediment traps

2.0 Factual Determinations

The factual determinations are applicable to both the overall comprehensive plan and the Corps participation unless noted otherwise.

2.1 Physical Substrate Determinations

2.1.1 Substrate Elevation and Slope

The new Bypass Channel would connect to the existing Clear Fork and West Fork of the Trinity River at the same elevation as existing channel. This area is within the scope of the Corps participation.

2.1.2 Sediment Type

No previous sediment transport studies in the Trinity watershed reaches potentially affected by the Modified Central City Project were found which includes the Corps portion of the Modified Central City Project. The sediments in the project area are anticipated to be similar to that found in the geotechnical investigation performed for the project and other portions of the Trinity floodplain which have been described as alluvium floodplain deposits including indistinct low terrace deposits, gravel, sand, silt, silty clay and organic matter.

2.1.3 Fill Material Movement

Excavated material would be used for subsequent fill operations on the project. Fill material as placed during the Modified Central City Project including the Corps portion of the project would be permanently stabilized to minimize the potential for movement or erosion of these areas. Permanent soil stabilization practice would include slope vegetation with native plantings and in potential high energy area concrete or other armor would

be used to protect the areas and minimize adverse impacts to aquatic and terrestrial habitat.

2.1.4 Physical Effects on Benthos

Temporary effects to benthos would occur during the construction process. Temporary fill in the form of coffer dams or sheet piling would have direct impact on the area of fill and would have additional temporary effect on the areas that would be dewatered prior to construction of the three isolation gates, Samuels Avenue Dam, Marine Creek Dam and the Interior Water Feature. The Interior Water Feature would be enlarged by removal of soil from the uplands adjacent to the Clear Fork and West Fork confluence area. Approximately 35 acres of river channel bottom would be filled with some of the material removed from the adjacent uplands. After completion of the Interior Water Feature, coffer dams would be removed and the area re-flooded. Benthic organisms are known to rapidly recolonize disturbed areas within streams and impoundments. Combined with the bypass channel, about 112 acres of new lentic habitat would be developed including substrate for development of benthic habitat.

As most of the aquatic habitat within the study area is greatly influenced by in-channel dams, primary long-term effects on the stream habitat occurred following placement of the dams. The increased depth of flooding over portions of the study area would not result in significant effect on benthos as productive zones would be re-established along the slope of the channels and within the raised bed of the Interior Water Feature.

Due to the inundation of approximately 2,700 feet of Marine Creek there would be a shift from benthic organism's characteristic of flowing water habitat to those adapted to more lake-like conditions. Fisheries sampling within Marine Creek indicate that important fisheries that rely on benthic organisms associated with shallow riffle/pool sequencing are present.

Both the temporary negative impacts and the potential long term positive impacts are within the scope of the Corps participation of the project.

2.1.5 Other Effects

None.

2.1.6 Actions Taken to Minimize Impacts

Efforts will be made to avoid or preserve valuable aquatic and terrestrial habitat concurrent with achieving the project, flood damage reduction, ecosystem improvement and recreational goals Adverse impacts during construction would be minimized through the implementation of erosion control and storm water pollution prevention measures such as silt fences, temporary and permanent soil stabilization practices, and turbidity barriers. To compensate for unavoidable adverse impacts, an aquatic mitigation plan that incorporates additional aquatic habitat mitigation has been developed in Ham Branch, a tributary to the West Fork Trinity River that crosses the floodplain on the right bank downstream of the existing Trinity Railway Express crossing, and in Sycamore Creek at the Riverside Oxbow site.

2.2 Water Circulation, Fluctuations, and Salinity Determinations

2.2.1 Water Chemistry

The State of Texas biennial inventory indicates historical compliance with standards for all water quality parameters in the stream segments affected by the project. The proposed project which includes the Corps participation is not expected to change this.

The impact of the proposed project on dissolved oxygen (DO), nutrients, biochemical oxygen demand (BOD), and phytoplankton (as measured by chlorophyll a) as functions of stream hydrology and hydraulics, upstream

loadings, in stream kinetics, and environmental conditions (temperature, light levels, and wind speed) was assessed. The United States Environmental Protection Agency (USEPA) Water Quality Analysis Simulation Program (WASP) version 6.0.0.12 (USEPA 2004) was used to perform the majority of the analyses. The result of this modeling indicates no adverse impact to dissolved oxygen below stream standards. Full discussion of the modeling results is included in the SEIS.

2.2.1.1 Salinity

Not applicable.

2.2.1.2 Clarity

There would be a temporary increase in turbidity when the bypass channel and dam structure is opened to the flow of the river; however this should be limited to the initial stabilization period. Coffer dams would be used during construction to minimize erosion around work zones open to flow from the river. Clarity temporary impacts are within the scope of the Corps participation.

2.2.1.3 Color

During all but extreme low flow events there is no concern related to changes in color of water as compared to the existing conditions. During extreme low flow events occurring during warm seasons, the potential for concentrations of algae to increase is possible within the enlarged impounded area. This could increase the potential for the water to be greener that would occur without the project during those conditions. The potential for an increase in algae concentrations is within the scope of the Corps participation.

2.2.1.4 Odor

A slight chance for odor could result if under stratified conditions a release is being made from the bottom layers of the water at Samuels Avenue. Any additional odor problems would be of short duration and are not expected to be a significant problem since similar conditions currently exist at existing low water dams. The potential for temporary odor changes are within the scope of the Corps participation.

2.2.1.5 Taste

No water supply withdrawals exist within the area of influence of this project therefore no taste issues are anticipated.

2.2.1.6 Dissolved Gas Levels

Table 3 contains the associated water quality standards for DO to achieve the high aquatic life designated use associated with the stream segments affected by this project. Modeling results show that DO concentrations within the waterway proposed under the project would be maintained above the State of Texas standard of 5 mg/L and vary little from current conditions. These modeling results show the Corps participation would not cause any significant changes of Dissolved Oxygen concentration levels.

Table 3: Dissolved Oxygen Criteria for Waterways in the Central City Area.

Mean (mg/l)	Minimum (mg/l)	Spring Mean (mg/l)	Spring Minimum (mg/l)
5.0	3.0	5.5	4.5

2.2.1.7 Nutrients and Eutrophication

For the majority of the year, the Clear and West Forks of the Trinity River through downtown Fort Worth are essentially lakes. Low water dams/grade control structures throughout these reaches impound water into

quiescent linear lakes. Measured chlorophyll a concentrations (up to 50 – 90 µg/l) are indicative of possible eutrophication (Chapra 1998) in this system. However, these values are associated with warm, extended low-flow conditions and storm flows quickly "flush" the system. No additional sources of nutrients would be added to the system from this project; therefore, no additional eutrophication is anticipated from proposed changes to the system. These potential impacts are within the scope of the Corps participation because the dam creates the lake impoundments even though the impoundment is not a direct element of the Corps participation.

2.2.2 Current Patterns and Circulation

2.2.2.1 Hydrologic Regime

The West Fork of the Trinity River in downtown Fort Worth is formed by the confluence of the West Fork and the Clear Fork. The West Fork above the Clear Fork confluence drains 2085 square miles while the Clear Fork drains 521 square miles. Major impoundments, including Lake Worth, Eagle Mountain Lake and Lake Bridgeport on the West Fork and Benbrook Lake on the Clear Fork have a profound effect on the flow regime in the downtown area. Within the study area, the lower end of the reach is impounded to elevation 500 feet by the Fourth Street Dam, the next upstream reach is inundated at elevation 505 by TRWD Dam, and Nutt Dam inundates reaches of the Clear Fork and West Fork to elevation 520.

United States Geological Survey (USGS) gauge records are available for the Clear Fork just above the existing confluence and for the West Fork just downstream of the confluence. Only flows recorded since October 1956 were used; thus the effects of Lake Worth and Benbrook Lake are included in the analysis. The mean flow in the West Fork during this period was 423 cubic feet per second (cfs), with an average of 148 cfs contributed by the Clear Fork. The median flows of the West Fork and Clear Fork were 34 cfs and 19 cfs, respectively. These flows are subject to substantial seasonal and year-to-year variability. Mean annual flows on the West Fork have been as low as 25 cfs (recorded in 1978) and as high as 1828 cfs (recorded in 1990). Drought years in the mid-1950s produced even lower flows. The average West Fork flow follows a seasonal pattern that peaks in May and falls to an annual minimum in August. The median mean August flow is 39 cfs and the median minimum daily flow of the year is 3.9 cfs.

The West Fork flow regime would be altered during extreme storm events by the proposed University Drive Hydraulic Mitigation improvement. Under proposed conditions there is no anticipated alteration of the current Clear Fork flow regime above the Clear Fork Gate. Minor flow changes below Clear Fork Gate would occur during normal flows, however, in the event of a major storm event, the Clear Fork Gate closure would reroute flows to the bypass channel. Major changes between 7th Street and Samuels Avenue would occur due to construction of the Bypass Channel and interior water feature. During low flows, water levels would be maintained at approximately 524.3 feet, which would create a pool from Samuels Avenue Dam, upstream on the West Fork above the confluence for a distance of 32,000 ft (6.1 miles) and along the Clear Fork above the confluence for 4,650 ft (0.88 miles).

2.2.2.2 Current Pattern and Flow

The flow supply to the Modified Central City Project area would continue in much the same quantity as under current conditions. After construction of the bypass channel, circulation in the existing system would be altered. However, this is not expected to have a significant effect on water quality. This alteration is within the scope of the Corps participation.

2.2.2.3 Velocity

Under existing conditions, velocity varies from approximately 4.8 feet per second in the vicinity of Fourth Street dam on the West Fork just downstream of the Highway 121 Bridge to 11.7 feet per second at the North Main Street Bridge crossing for the 100 year storm event. As a result of implementation of the project, velocity increases in the 100 year event are generally less than 1.0 feet per second with the exception of the entrance to

the proposed bypass channel and at University Drive Hydraulic Mitigation site where appropriate armoring would be included in facilities design. The velocity changes at the entrance of the proposed bypass channel and at University Drive Hydraulic Mitigation site are within the scope of the Corps participation.

2.2.2.4 Stratification

It is expected that the waterway as proposed would stratify thermally. Stratification has been observed at times in the existing waterway and historical data from these impoundments demonstrate compliance with the DO standard in the epilimnion (as required by the State of Texas). Evaluation of the project conditions indicate that stratification would occur, but to no greater degree that has historically occurred, indicating that the proposed project would meet water quality standards for DO (see Water Quality Impact Assessment in SEIS). The Corps participation would not have any significant negative impacts to the stratification.

2.2.3 Normal Water Level Fluctuations

Minimal fluctuation in water levels is expected under normal flows because the Samuels Avenue Dam would be used to control water levels. However, during extreme storm conditions, water level variations can be expected. Water surface elevations under such conditions are summarized in **Table 4**. Storm event water levels under proposed conditions are generally less than existing conditions. These water level fluctuations during extreme storm conditions would be less than existing conditions due to the Corps participation of this project.

Table 4: Water Surface Elevations at Specified Stations Along the Trinity River.

		Existing Conditions - Water Surface Elevation				
Station	**Approx. Location**	**Median flow**	**Annual average flow**	**2-yr**	**10-yr**	**100-yr**
222998	West Fork at Riverside Dr.	488.4	488.8	506.3	515.0	520.0
237615	West Fork at N. I-35W	500.7	501.3	507.4	516.4	522.9
243471	West Fork at Marine Creek Confluence	500.7	501.3	509.0	517.7	525.1
262599	West Fork at University Dr.	520.1	520.2	528.4	533.1	541.4
		Proposed Conditions - Water Surface Elevation				
Station	**Approx. Location**	**Median flow**	**Annual average flow**	**2-yr**	**10-yr**	**100-yr**
222998	West Fork at Riverside Dr.	488.4	488.8	505.9	514.0	519.6
237615	West Fork at N. I-35W	500.7	501.3	507.1	515.5	522.5
243471	West Fork at Marine Creek Confluence	524.3	524.3	511.6	517.2	525.1
262599	West Fork at University Dr.	524.3	524.4	525.6	530.7	540.2

2.2.4 Salinity Gradients

Not applicable.

2.2.5 Actions to be Taken to Minimize the Impacts

The impact on water quality for the proposed project configuration was analyzed as a part of the preliminary design of the project. The analysis demonstrates that the project would have no significant impact on water quality. Results of this analysis are discussed in detail in the SEIS. The assessment did recognize that because flows during dry periods are slight (approximately 5 cubic feet per second), it may be beneficial to implement practices to manage circulation and water quality and aesthetics in the system. Several options to accomplish

this have been considered and would be further evaluated during final design. These options could be necessary for both the overall comprehensive plan and the Corps participation. Criteria for consideration of these and possible new options would include cost effectiveness and sustainability:

Augmenting flow with other sources. The supply augmentation options discussed in Section 3.0 of the FEIS would provide the benefits of increasing circulation within the system.

Inducing large scale circulation mechanically. Several mechanical means could be used to induce circulation throughout the waterway. Subsurface pumps could be employed to force large volumes of water to move within the channel associated with the system. The proposed storm water pump station for the interior waterway could be configured to accomplish this in addition to its primary function of conveying larger storm flows.

Inducing localized circulation mechanically. Surface aerators (commonly seen as fountains) could induce circulation in localized areas if needed. Pumps could be used to pull water from the waterway and allow it to return to the waterway over cascades or other aesthetic features on a localized basis. This option is outside the scope of the Corps participation.

Provide additional hydraulic structures to direct flow as needed. Hydraulic structures could be configured within the waterway such that low flows are distributed as desired to have complete circulation within the system. These structures, likely subsurface and analogous to grade control structures, would have no effect on the performance of the system in regards to larger flood flows.

2.3 Suspended Particulate/ Turbidity Determinations

2.3.1 Expected Changes at Discharge Sites

There could be temporary increases in suspended particulate and turbidity levels during storm events prior to permanent stabilization. These increases, however, would be of a short duration and tolerable to aquatic organisms downstream. Construction design and phasing have been planned to minimize turbulence and generation of suspended particulates through the use of temporary erosion control measures and soil management plan defining silt fences, interceptor swales, and sediment traps requirements . The temporary increases in suspended particulate and turbidity levels during storm events prior to stabilization are within the scope of the Corps participation at the discharge sites.

2.3.2 Effects on Chemical and Physical Properties of the Water Column

2.3.2.1 Light Penetration

The proposed project would not change the depth to which light penetrates within the water column.

2.3.2.2 Dissolved Oxygen

Water quality models demonstrate that dissolved oxygen concentrations would be changed very little by the proposed project and would remain above the State of Texas standard of 5 mg/L (see Water Quality Impact Assessment in SEIS for more detailed discussion). These changes discussed are impacts that are within the scope of the Corps participation.

2.3.2.3 Toxic Metals and Organics

The Modified Central City Project is contained within two State of Texas River Segments of the Trinity River, Segment 0806 West Fork below Lake Worth and Segment 0829 Clear Fork below Benbrook Lake. The lower one mile of segment 0829 from 7th Street to the confluence with the West Fork and the lower 22 miles of Segment 0806 from the confluence of the Clear Fork have been listed by the State of Texas as not meeting water

quality standards because of high levels of chlordane in fish tissue. This designation lead to the development and implementation of a Total Maximum Daily Load (TMDL) process specific for that waterway and legacy pollutant and is addressed through the TMDL for Legacy Pollutants in Streams and Reservoirs in Fort Worth (TNRCC 2001).

The Texas Commission on Environmental Quality (TCEQ) has prepared an implementation plan; Implementation Plan for Fort Worth Legacy Pollutant TMDLs (TNRCC July 2001) for this TMDL and will continue to monitor chlordane in fish tissue in the Fort Worth area. The TMDL monitoring data showed that chlordane is declining in the environment because improved environmental practices. Recent sampling by the United States Fish and Wildlife Services (USFWS) found that chlordane concentrations in fish tissue have decreased slightly within the project area (USFWS 2004) and does not appear on the 303(d) list. Existing evaluations indicate there is no known reason why the proposed project would increase the likelihood of chlordane in the waterway. In addition, portions of Segment 0806 (lower 22 miles) and Segment 0829 lower mile are listed on the Draft 2006 Texas 303(d) List (June 27, 2007) as Category 5 *does not meet applicable standards for PCB's*. This designation requires the development and implementation of a TMDL. The category is further classified as 5a – *a TMDL is underway, scheduled or will be scheduled.* The target date for the TMDL is 2010.

The project is being structured such that all construction will comply with the TMDL plan set forth by TCEQ which requires appropriate management practices to limit sediment discharge. As a precursor to construction, additional analytical sampling will be done within areas impacted by excavation or fill. The additional analytical sampling that will be done will be in areas that are within the Corps participation. Regional storm water monitoring and an assessment of other permitted discharges in the region indicate that no other toxic metals or organics are expected in the waterway currently or as a result of the proposed project.

2.3.2.4 Pathogens

The lower 22 miles of Segment 0806 West Fork Trinity River below Lake Worth is included on the Draft 2006 Texas 303 (d) list (June 27, 2007) as not meeting applicable standards for bacteria. It is listed as category 5 a, *TMDL is underway, scheduled, or will be scheduled.* The target date for the TMDL on the West Fork Segment is 2009.

In addition, two unclassified water bodies 0806D Marine Creek, a two mile stretch upstream of the confluence with the West Fork and 0806E Sycamore Creek, five mile stretch upstream from the confluence with the West Fork. These are listed as category 5c – *additional data and information to be collected.*

There currently are no municipal wastewater treatment facilities discharging upstream of the immediate project area. As such, bacteria currently contributed to these reaches of the Trinity River come from urban and rural runoff. The changes resulting from the proposed project would not result in any increase in bacteria within the affected waterways. It is anticipated that, over the long-term, the project may even reduce bacterial loads through improved urban runoff management practices and upgraded wastewater collection systems within the project area. TRWD currently monitors waterways associated with the proposed project for bacteria and posts signs in public areas prohibiting contact recreation when bacterial counts exceed State criteria.

2.3.2.5 Aesthetics

As discussed in 2.2.5, several options would be considered in final design to maintain aesthetics including:

- Augmenting flow with other sources;
- Inducing large scale circulation mechanically;

- Inducing localized circulation mechanically; and

- Provide additional hydraulic structures to direct flow as needed.

An adverse impact to water aesthetics in urban areas is floatable material. Typically litter that has washed into drainage ways with storm water runoff, floatable material can aggregate on waterway banks and collect on structures creating unsightly clutters of trash. While the project per se would not cause additional sources of floatables, the increased public use of the area is anticipated to result in the need to further reduce the undesirable effect of floatables within the area. In conjunction with the additional hydraulic assessments associated with final design of the project, studies would investigate how floatable material would interact within the system and provide design strategies to minimize adverse interactions including review of the Corps participation. The local sponsor, TRWD, is already experimenting with strategies to identify sources of floatables to the Trinity basin and how existing movement of these materials can be reduced by capturing and removal through use of netting, booms, etc.

Aesthetics of the water course depend on water appearance, odor, and taste (if a drinking source). The water color and clarity in the general vicinity of the project area is similar to other portions of the Trinity River. It should be noted that the TCEQ report "Draft 2006 Texas Water Quality Inventory" (TCEQ, 2006) documented that algal growth was of "no concern" in a relatively large portion (about 9 of 14 miles) of the Clear Fork below Benbrook Lake (TCEQ Stream Segment 0829) based on chlorophyll *a* water sample test data and that remaining portion of this stream segment was not assessed for algal growth. In the same report, water in the West Fork in an 11-mile reach below Lake Worth was not assessed for algal, but water below this reach (lower 22 miles of TCEQ Stream Segment 0806) was identified as an algal growth "concern" based on chlorophyll - a screening assessment. Based on this information, the existing water in the vicinity of the project area will have probable episodes of algal growth in late spring-summer months. On such occasions, water color may take on a green cast, but significant floating algal mats are not known to occur. Water in the project vicinity is currently not used as a public water supply source and the taste quality of existing area waters is not known. If used as a public water source, it anticipated that the taste quality after water treatment would be similar to treated water from Benbrook Lake and Lake Worth. On the whole, the aesthetic appeal is considered good and similar to the shallow lake fringes of Benbrook Lake and Lake Worth.

Construction activities for the comprehensive Modified Central City Project, including the Corps participation component, will temporarily affect stream turbidity which will hence have temporary adverse effect on stream aesthetics. However, storm water controls, erosion controls, silt fences or hay bales, and onsite best management practices such as siltation pounds, dust control and stabilized construction entrances will be incorporated into the project construction activities such that effects will be minimal and temporary. Algal growth would be a potential aesthetic concern if stream stagnation occurs as result of increased evaporation and low downstream releases. However, the Modified Central City Project is flexible by design and would allow flows through the system to simulate a similar flow-through condition as the existing stream. Further, the maintenance of a good aesthetic appeal of the water course is a primary proponent objective. In addition, other water quality features have been suggested by the proponent to further improve water quality aesthetics beyond the existing conditions.

2.3.2.6 Others as Appropriate

None.

2.3.3 Effects on Biota

There are no anticipated measurable effects to important biota related to water quality changes attributable to the project.

2.3.4 Actions taken to Minimize Impacts

Additional water quality data collection and refinement of water quality and hydraulic modeling tools will be undertaken during the course of project design and implementation in order to guide activities in a manner that minimize impacts to water quality. This includes all features of the Modified Central City Project, including the Corps participation, because they are interdependent and therefore cannot be separated for purposes of water quality and hydraulic modeling. The Project Management Plan for the Modified Central City Project will include review of the design and plans and specifications by appropriate personnel to insure they include actions necessary to minimize impacts to water quality.

2.4 Contamination Determinations

Prior to excavation activities and particularly for the bypass channel or interior water features, Phase II Environmental Site Assessments (ESAs) will be conducted in areas with known or potential soil contamination. The results from the Phase II ESA(s), and any following contaminant delineations that may be required, would be used to determine the proper handling procedures during excavation of the impacted areas. A soil management plan will be developed for areas with soil contamination. The plan would include a description of the nature and extent of the contamination, including figures, with delineation of contamination, volume of expected contaminated material, and soil handling methodologies (screening, segregation, treatment/discharge methods, etc.). The majority of the excavation activities are within the scope of the Corps participation and ESA's will be conducted accordingly.

If contaminated soils that exceed regulatory standards are found during construction, they would be handled and disposed of in accordance with all State and federal regulations that could include (but are not limited to):

- Placement in a Subtitle D landfill;
- Placement in a Subtitle D landfill after on-site treatment; or
- Placement in a Subtitle C hazardous waste landfill/discharge facility.

The appropriate discharge method would be determined by the chemical characteristics of the soil, effectiveness of the method for protecting the environment, regulatory requirements and cost.

Soil handling and discharge would be conducted in accordance with the applicable local, state, and federal laws, regulations, and rules. Coordination with the appropriate regulatory agencies would help guide the soils excavation, remediation, reuse, and discharge efforts during the establishment of the Trinity River bypass channel. These procedures and considerations are incorporated into the plans for executing the Corps participation.

2.5 Aquatic Ecosystem and Organism Determinations

Temporary effects to West Fork and Clear Fork aquatic ecosystem would occur as a result of construction sequencing of the proposed project. Coffer dams and temporary diversions would contribute to short term effects.

Long term effects would be attributable to the permanent structures and the operation of the project. Because the West and Clear Forks through downtown Fort Worth are currently impounded by low water dams, the extension of that impoundment by the construction of Samuels Avenue Dam would not have any substantial effect on biota within the river itself. However, exceptional and high quality aquatic habitat within Marine Creek would be adversely impacted as a result of inundation effects of the Marine Creek Low Water Dam. The effects of significance would be from the loss of riffle pool complexes. Other adverse impacts to wetlands and riparian forest habitat would occur from construction of the project. As identified in the Modified Central City

alternative SEIS, the project would impact only 0.8 acres of wetlands but would only impact 0.14 average annual habitat units (AAHUs) . In addition the comprehensive activities associated with the modified alternative would impact about 12.4 acres of riparian forest having 8.12 AAHUs. These impacts would result in negative responses by fish and wildlife resources of the study area if left unmitigated. These impacts would be caused by the Corps participation specifically the results of the Samuels Avenue Dam operations.

Wetlands and riparian habitat losses would be compensated by the development of ecosystem improvement measures associated with the Riverside Oxbow habitat development, West Fork Rockwood and West Fork South (Ham Branch drainage area) sites. Riparian forest development and management would provide a net gain of 109.8 AAHUs of riparian forest over the 8.12 AAHUs lost as a result of the project. Approximately 58 acres of wetlands would be provided at the Riverside Oxbow sites that would result in the ultimate provision of a net gain of 47.78 AAHUs of wetland values. Monitoring of the ecosystem improvements would be conducted throughout establishment of wetland and woodlands. Adaptive management would be incorporated as necessary to assure success of the environmental mitigation. The wetland and riparian forest development needed to compensate for modified city alternative impacts are within the scope of the Corps participation.

The USFWS has provided Planning Aid Letters, information that was utilized during the planning of this project, and has coordinated with the Corps and local sponsors, and has approved a plan to partially mitigate the impacts caused by inundating exceptional and high quality Marine Creek lentic aquatic habitat through the proposed aquatic improvements at Ham Branch. In addition Sycamore Creek aquatic benefits of the modified plan are being evaluated by resource agencies during review of this document and the Draft SEIS.

Aquatic mitigation at Ham Branch and Sycamore Creeks was found to be necessary to fully compensate aquatic impacts and would be completed following studies to determine a stream configuration that is geomorphically stable based upon hydrology, sediment characteristics and slope. Typical cross-section and plan view of proposed mitigation features are presented in Appendix E to the SEIS. The aquatic mitigation at Ham Branch and Sycamore Creek is within the scope of the Corps participation.

At Ham Branch, development of a riparian forested buffer of 50 foot in width on either side would produce both riparian forest and stream aquatic benefits. Contouring of the channel bank as necessary to provide appropriate interaction between the riparian vegetation and the aquatic environment would be done prior to reforestation. The Riparian plantings would include dense development of shrubs and overhanging grasses near the creek channel. Approximately 305 feet of the existing channel would be relocated to provide adequate width for riparian forest development adjacent to an existing fenced soccer field. Riparian forest would be planted on 7.4 acres and the existing 1.4 acres of riparian forest would be improved to provide a total 8.8 acres along the creek. Pending further investigation, approximately 25 percent of the total length (3,568 feet) of the stream segment would be modified to provide approximately 900 linear feet of rock based riffles at locations to be determined by those additional studies. This riparian reforestation and re-contouring mitigation is within the scope of the Corps participation.

Aquatic habitat benefits on Ham Branch would accrue on 3,568 linear feet of stream channel and should provide up to 0.80 AAHU over the without project conditions. The benefits to mitigating within Ham Branch would extend beyond the creek. It is anticipated that significant benefits to the water quality and fisheries within the West Fork immediately adjacent to the confluence should occur; however, current methods to quantify those benefits are unavailable. In addition, the construction of the riparian corridor adjacent to Ham Branch would provide additional significant forest resources in the lower end of the study area, supporting resource agencies recommendations to provide resources of this type at additional locations within the study area.

Proposed stream habitat improvement within the Riverside Oxbow includes restoring the severed Sycamore Creek Oxbow. The available slope from the proposed connection to the Trinity River, through the Sycamore Creek Oxbow channel and the West Fork Oxbow to its confluence with the main stem of the West Fork below

Beach Street Dam is only approximately 6 feet, of which only approximately 1 foot of fall would be through Sycamore Creek and the remaining would be in the Riverside Oxbow. A series of rock weirs would be utilized in the oxbow and smaller rock structures would be developed in Sycamore Creek to provide the basis for developing pools, riffles, and runs through the entire system. See Figure 12 of the SEIS for the approximate locations of the rock weirs.

Sycamore Creek channel reconstruction would average 10 feet in width at riffle control structures and would have average depth of about 1-2 feet over its approximate 3200 foot restored length. Average velocity through the riffle complexes would be about 1 foot per second at the mean low flow of 10 cfs, which would be beneficial to anticipated darter utilization of the riffles and provide sufficient oxygenation within pools to support a wide variety of high value fisheries.

Stream bank riparian grasses along with preserved specimen burr oak and pecan trees existing along the alignment of the restored Sycamore Creek would provide shading, cover and supplemental food components to the aquatic system. Based upon this concept, which mimics high quality streams within the Central City study area such as lower segments of Marine and Lebow Creek it is anticipated that the Sycamore Creek Channel as restored would ultimately provide at minimal 0.75 acres of high value aquatic habitat. An Index of Biotic Integrity (IBI) score of 47 was estimated to be appropriate for Sycamore Creek as proposed to be restored. Following the methodology that was utilized in the original Central City EIS, an IBI score would translate into an estimated future with project habitat suitability of 0.85. Since the stream based aquatic habitat would provide fisheries benefits to the entire 3200 feet of restored Sycamore Creek there would be a minimum of 0.64 habitat units established. As flow would be maintained during all times of each year, the seasonally adjusted habitat units and average annual habitat units attributable to stream restoration in Sycamore Creek would also be 0.64.

Stream impacts would be fully mitigated by implementation of the aquatic mitigation plan at the Ham Branch site referenced in the original Central City EIS, and by implementation of restoration of flows through Sycamore cutoff with developed in-channel riffles and pools as a component of the Modified alternative. Table E-3 of the SEIS displays the analysis of stream based aquatic impacts, mitigation improvement analysis. With Sycamore Creek using a conservative estimate of 0.75 acres of stream habitat, the net AAHU after implementation of improvements would result in a net gain of 0.22 AAHUs. This difference is considered to be within the margin of error for this analysis and therefore it can be presumed that the stream aquatic impacts are fully compensated by the implementation of Hams Branch and Sycamore Creek channel improvements. Additional benefits from returning base flows and structural habitat modifications of aquatic habitat of the Riverside Oxbow would be restoration benefits in excess of those determined for the original Riverside Oxbow study. The modified alternative would provide stream aquatic habitat benefits of 4.8 AAHUs while the no action alternative provided no documented net stream aquatic habitat benefits.

2.6 Proposed Discharge Site Determinations

Placement of material into waters of the United States would be occur in areas where temporary construction such as coffer dams would allow for care of water and within the footprint of Samuels Avenue Dam, the three isolation gates, and within 35 acres of channel bottom within the identified Internal Water Feature and stabilization of the bypass channel sides and bottom. Most of the identified discharge sites are outside of the ordinary high water mark of the Trinity River system or would be conducted in the “dry”. Alternative locations were evaluated for location of the main structural components as discussed in the body of the EIS. These discharge sites are within the scope of the Corps participation.

2.7 Determination of Cumulative Effects on the Aquatic Ecosystem

Cumulative impacts resulting from the incremental consequences of the comprehensive proposed project when added to other past and reasonably foreseeable future actions were considered in the FEIS. The cumulative effects of the action were viewed in the context of direct and secondary impacts of the comprehensive project

when incrementally added to all known reasonably foreseeable actions within the geographic area. Significant direct impacts to wetlands, riparian woodlands and the stream habitat of Marine Creek were identified during project evaluation. Plans to mitigate those resources have been developed and a cumulative effects analysis was thoroughly discussed in Chapter 4 of the SEIS. Complete plan development would provide for cumulative beneficial impacts to wetlands, riparian woodlands and pending completion of the compensatory plan to mitigate stream aquatic habitat losses, no cumulative effects to the aquatic ecosystem. All proposed mitigation is within the scope of the Corps participation which is a portion of the Modified Central City Project.

2.8 Determination of Secondary Effects on the Aquatic Ecosystem

Secondary impacts are those that are caused by an action and are later in time or farther removed in distance but are still reasonably foreseeable. These impacts are induced directly or indirectly by the proposed project. Secondary effects considered in the FEIS included changes in land use; economic vitality; neighborhood character; traffic congestion, with its associated effects on air quality and noise; water quality and aquatic resources and other natural resources. The secondary impacts that are projected to occur were identified and evaluated as part of the comprehensive project and referred to as the "Trinity Uptown Features" within the FEIS. No significant adverse effects to the aquatic ecosystem were found to be attributable to the Trinity Uptown Features which includes all portions of the Corps participation.

3.0 Findings of Compliance for Fort Worth Modified Central City

- No significant adaptations of the guidelines were made relative to this evaluation.

- The No Action and other alternatives analyzed in the Central City FEIS and Riverside Oxbow EA were determined to be not practicable because they do not fully meet the goals and objectives of the Trinity River Vision Master Plan which is the document referenced in the authorization. A number of alternative locations, configurations, and sizes of specific features of the Modified Central City Project were considered taking into account cost, existing technology, and logistics in light of the overall project purposes. The recommended location, configuration, and size of these features are considered the least environmentally damaging practicable alternative.

- Based on discussions with the representatives from the Texas Commission on Environmental Quality (TCEQ), the proposed disposal of materials at locations identified would not violate any applicable State water quality standards. The Corps will continue coordination with TCEQ and no construction affecting waters of the United States will commence until the 401 State Certification has been issued. This certification will be made part of the official record.

- Use of the selected disposal sites will not affect any federally listed threatened or endangered species or their critical habitat.

- The comprehensive Modified Central City Project which includes the Corps participation would not violate terms and conditions of the CDC or Trinity Regional EIS ROD for preventing cumulative impacts to hydrologic resources.

- The proposed disposal will not result in significant adverse effects on human health and welfare, recreational fishing, plankton, fish, shellfish, wildlife or special aquatic sites provided the recommended environmental mitigation and ecosystem improvements are incorporated into the project. If the Corps participation in mitigation were not completed, the proposed discharge could potentially have adverse impacts to human health and welfare, recreational fishing, plankton, fish, shellfish, wildlife and special aquatic sites.

- Appropriate steps to minimize adverse impacts include use of best management practices during construction, working in the stream channel under "dry" conditions to the extent possible and opening the bypass channel during a period of flows that would minimize turbidity development. These steps will be incorporated into all activities of the Corps participation.

- On the basis of the guidelines, the proposed disposal sites for the discharge of dredge material, as specified, comply with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the aquatic ecosystem.

In an effort not to piecemeal the impacts of these activities this analysis reviewed the overall comprehensive impacts to ensure cumulative impacts are consider as required by 33 CFR part 1508.25. If the analysis did separate the Corps project from the remaining portions of the Modified Central City Project in general the impact from the fill material would decrease in amount and size of the footprint. This would equate to an overall decrease in adverse impacts but would also not fulfill the overall project purpose and objectives. Additionally many benefits of the public interest factor would not be weighed and balanced as appropriate with connected actions.

4.0 References

Upper Trinity River Central City Final Environmental Impact Statement: USACE January 2006.

Riverside Oxbow, Upper Trinity River Interim Feasibility Report and Integrated Environmental Assessment : USACE Revised April 2005 with Addendum.

CDM [April 2006]: Draft Environmental Impact Statement, Appendix B: Initial Geotechnical Investigation for the Preliminary Design of the Fort Worth Central City Project.

Dawson, W. C., McNulty, C. L., Reaser, D. F., Leaders, 1979, Field Trip Guidebook for Stratigraphy and Structure of Selected Upper Cretaceous Rocks in Northeast Texas (Texas Academy of Science 82nd Annual Meeting, Arlington, Texas).

Fisher, W. L., Director, 1972, "Geologic Atlas of Texas, Dallas Sheet" Bureau of Economic Geology, The University of Texas at Austin, Austin, Texas. 1972.

Fort Worth Central City Preliminary Design- Appendix A; Hydrology and Hydraulics; Submitted to the USACE, Ft. Worth District; Tarrant Regional Water District; Fort Worth, Texas; January 2005.

TCEQ Draft 2006 Texas 303(d) list (June 27, 2007).

Fort Worth Central City Preliminary Design- Appendix C; Civil/Structural Preliminary Design; Submitted to the USACE, Ft. Worth District; Tarrant Regional Water District; Fort Worth, Texas; January 2005.

Geology of Tarrant County [circa 1919], UT Austin Bulletin No. 1931.

Sellards, et al [1932]. The Geology of Texas., Bureau of Economic Geology, University of Texas Bulletin No. 3232.

USACE [June 1987]. "Special Project Report, Tony's Creek and Marine Creek, Tarrant County, TX".

N
W
E
S

LEGEND

- BYPASS CHANNEL AND ISOLATION GATES
- ROAD IMPROVEMENTS
- WATER FEATURE
- PEDESTRIAN BRIDGES
- VALLEY STORAGE SITES
- DISPOSAL SITES
- ECOSYSTEM IMPROVEMENT
- AQUATIC HABITAT MITIGATION AREA
- TRINITY UPTOWN AREA

MARINE CREEK LOW WATER DAM
MARINE CREEK
PEDESTRIAN BRIDGE
SAMUELS AVENUE DAM
SAMUELS SITES
SAMUELS AVE
INTERSTATE 35
JACKSBORO HWY
ROCKWOOD PARK - WEST SITE
ROCKWOOD PARK ECOSYSTEM IMPROVEMENT
WEST FORK TRINITY RIVER
TRWD GATE/ PUMP STATION
N MAIN ST BRIDGE
BYPASS CHANNEL
UNIVERSITY DR
PEDESTRIAN BRIDGE
TRINITY POINT GATE
WHITE SETTLEMENT RD BRIDGE
TRINITY UPTOWN AREA
RIVERSIDE PARK SITE
HIGHWAY 121
RIVERSIDE OXBOW/GATEWAY PARK SITES
1ST ST
4TH ST
HAM BRANCH SITE
PEDESTRIAN BRIDGE
HENDERSON ST BRIDGE
MAIN ST
INTERIOR WATER FEATURE
WHITE SETTLEMENT RD BRIDGE
CLEAR FORK GATE
7TH ST
OLD OXBOW SYCAMORE CREEK
BEACH STREET RECONSTRUCTION
PEDESTRIAN BRIDGES
SYCAMORE CREEK
CLEAR FORK TRINITY RIVER
RIVERSIDE DR
BEACH ST

0 2,500 5,000
SCALE IN FEET

CDM

FORT WORTH CENTRAL CITY
SECTION 404(b)(1) ANALYSIS

MODIFIED CENTRAL CITY PROJECT

DATE: MARCH 2008

FIGURE 1

N
W
E
S

LEGEND

- NHD WATER FEATURES
- EXISTING VEGETATION CLASS: WETLAND

Note: Water features are based on National Hydrography Dataset products (Publication Date 2005). This figure may not accurately display or represent all of the inclusive waters of the United States of America.

JACKSBORO HWY
MARINE CREEK
LEBOW CREEK
INTERSTATE 35
WEST FORK TRINITY RIVER
SAMUELS AVE
HIGHWAY 121
1ST ST
4TH ST
OLD OXBOW WEST FORK
WEST FORK TRINITY RIVER
UNIVERSITY DR
MAIN ST
HAM BRANCH
OLD OXBOW SYCAMORE CREEK
7TH ST
CLEAR FORK TRINITY RIVER
SYCAMORE CREEK
RIVERSIDE DR
BEACH ST

0 2,500 5,000
SCALE IN FEET

CDM

FORT WORTH CENTRAL CITY
SECTION 404(b)(1)
ANALYSIS

WATERS OF THE U.S. FROM THE NATIONAL HYDROGRAPHY DATASET

DATE: MARCH 2008

FIGURE 2

N
W
E
S

LEGEND

- CONSTRUCTION AREAS WITHIN OHWM
- NHD WATER FEATURES
- EXISTING VEGETATION CLASS: WETLAND

Notes:
1. For the purpose of this analysis, the Ordinary High Water Mark (OHWM) is defined as the existing 2-yr water surface elevation by USACE and was used to define impacts within the waters of the U.S. (NHD).

2. Construction areas as shown are for graphical purposes only and may not accurately display or represent all of the area within the ordinary high water mark.

MARINE CREEK CHANNEL IMPROVEMENT
MARINE CREEK LOW WATER DAM
MARINE CREEK
INTERSTATE 35
SAMUELS AVENUE VALLEY STORAGE SITES
JACKSBORO HWY
SAMUELS AVENUE DAM
SAMUELS AVE
WEST FORK TRINITY RIVER
ROCKWOOD PARK - WEST VALLEY STORAGE SITE
ROCKWOOD PARK ECOSYSTEM IMPROVEMENT
LOWER BYPASS CHANNEL TIE-IN
TRWD ISOLATION GATE/ PUMP STATION
RIVERSIDE PARK VALLEY STORAGE SITE
HIGHWAY 121
WEST FORK PEDESTRIAN BRIDGE
LOWER BYPASS CHANNEL TIE-IN
TRINITY POINT ISOLATION GATE
RIVERSIDE OXBOW/GATEWAY PARK SITES
1ST ST
4TH ST
WEST FORK TRINITY RIVER
UNIVERSITY DR
UPPER BYPASS CHANNEL TIE-IN
INTERIOR WATER FEATURE
MAIN ST
UPPER BYPASS CHANNEL TIE-IN
CLEAR FORK ISOLATION GATE
HAM BRANCH AQUATIC MITIGATION SITE
BEACH STREET BRIDGE RECONSTRUCTION
7TH ST
RIVERSIDE OXBOW ECOSYSTEM DEVELOPMENT
SYCAMORE CREEK AQUATIC ECOSYSTEM DEVELOPMENT
CLEAR FORK TRINITY RIVER
SYCAMORE CREEK
RIVERSIDE DR
BEACH ST

0 2,500 5,000
SCALE IN FEET

CDM

FORT WORTH CENTRAL CITY
SECTION 404(b)(1) ANALYSIS

CONSTRUCTION AREAS WITHIN WATERS OF THE U.S.

DATE: MARCH 2008

FIGURE 3

N
W
E
S

LEGEND

- PEDESTRIAN BRIDGES
- VALLEY STORAGE CUT SITES
- UPLAND DISPOSAL FILL SITES
- BYPASS CHANNEL TIE-INS
- STRUCTURES

Notes:
1. For the purpose of this analysis, the Ordinary High Water Mark (OHWM) is defined as the existing 2-yr water surface elevation by USACE and was used to define impacts within the waters of the U.S. (NHD).

2. Construction areas as shown are for graphical purposes only and may not accurately display or represent all of the area within the ordinary high water mark.

MARINE CREEK LOW WATER DAM
MARINE CREEK
PEDESTRIAN BRIDGE
SAMUELS AVENUE DAM
SAMUELS SITES
SAMUELS AVE
INTERSTATE 35
JACKSBORO HWY
ROCKWOOD PARK - WEST SITE
WEST FORK TRINITY RIVER
LOWER BYPASS CHANNEL TIE-IN
TRWD ISOLATION GATE/ PUMP STATION
RIVERSIDE PARK SITE
HIGHWAY 121
UNIVERSITY DR
LOWER BYPASS CHANNEL TIE-IN
RIVERSIDE OXBOW/GATEWAY PARK SITES
1ST ST
TRINITY POINT ISOLATION GATE
4TH ST
HAM BRANCH SITE
UNIVERSITY DR
WEST FORK TRINITY RIVER
UPPER BYPASS CHANNEL TIE-IN
INTERIOR WATER FEATURE
MAIN ST
UPPER BYPASS CHANNEL TIE-IN
CLEAR FORK ISOLATION GATE
7TH ST
PEDESTRIAN BRIDGES
SYCAMORE CREEK
CLEAR FORK TRINITY RIVER
RIVERSIDE DR
BEACH ST

0 2,500 5,000
SCALE IN FEET

CDM

FORT WORTH CENTRAL CITY
SECTION 404(b)(1) ANALYSIS

CUT/FILL AREAS OUTSIDE WATERS OF THE U.S.

DATE: MARCH 2008

FIGURE 4