Section 404 (b)(1) Analysis
Fort Worth Central City
Central City Project

1.0 Project Description

1.1 Location and General Description

The Central City project, described as the Community Based Alternative in Chapter 3 of the FEIS 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 alternative are discussed in FEIS chapter 3. The project also includes hydraulic mitigation to comply with valley storage requirements. The hydraulic mitigation would be accomplished at three locations including the Riverbend, University Drive and downstream sites in the vicinity of Samuels Avenue and I-35. An in-channel dam just downstream of Samuels Avenue would impound water to a normal water surface elevation of approximately 525 feet. In addition, the Riverbend Hydraulic mitigation site would be ecologically restored to fully mitigate riparian and upland forest and emergent wetland losses due to the project. Two oxbows within the Rockwood Park area would be reconnected to the West Fork providing improved aquatic habitat to the system and mitigation for aquatic habitat losses due to inundation of portions of Marine Creek will be accomplished in Ham Branch and Lebow Creek.

The Corps of Engineers (Corps) component is a subset of the Central City project. The Corps component of this project includes the hydraulic features of a bypass channel, a new in-channel dam (Samuels Avenue Dam), flood isolation gates, all facets of mitigation, and all the land and relocation costs. Mitigation will include aquatic habitat mitigation at Ham Branch and Lebow Creek, hydraulic mitigation in two separate locations, and combined hydraulic and forest and wetland mitigation at the Riverbend site. Appropriate cultural resources mitigation measures for significant prehistoric or historic sites, in accordance with the National Historic Preservation Act are also included. Cultural resources mitigation normally consists of excavation of significant prehistoric or historic sites to obtain all available data prior to the construction activities which would likely destroy the resource. If unknown buried cultural resources are inadvertently discovered during construction the activities would cease and the State Historic Preservation Office (SHPO) notified and the appropriate mitigation measures completed before construction resumes. (Figure 5) Mitigation for the significant architectural resources is specified in a Programmatic Agreement in accordance with regulations under the National Historic Preservation Act."

The Specific Features of the Corps Component are discussed in FEIS Chapter 5, page 258.

1.2 Authority and Purpose

Corps participation in the Central City River Project was authorized by Section 116 of the Consolidated Appropriations Act, 2005 which directed the Corps to undertake the Central City River project as generally described in the Trinity River Vision Master Plan. The Trinity River Vision Master Plan's goals for the Central City River 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 (Chapter 3, FEIS). 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

The project authorization contained in Section 116 of the Consolidated Appropriations Act 2005 authorizes the Corps participation in the Central City project at a total cost not to exceed $220,000,000. Section 116 further establishes that the Corps and non-Federal share of that project will each be $110,000,000. This 404 (b)(1) analysis addresses the effects of the Central City River project, which includes the Corps component. Modification of the project authorization could change the level of Corps participation, however, if participation by the Corps is subsequently increased within the scope of this Central City project no further analysis or modification to this document would be necessary.

1.3 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." During the NEPA process the following alternatives were thoroughly reviewed: No Action Alternative, Principles and Guidelines Based Alternative (P&G alternative), and Community Based Alternative (comprehensive Central City River project). Within the P&G and Community Based Alternatives, alternative locations, configurations, and size of specific project features were analyzed.

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 was the only practicable alternative, and thus the least damaging practicable alternative. This plan substantially fulfilled the overall project goals described in the Trinity River Vision Master Plan (April 2005),

A dam near Samuels Avenue was determined to be necessary in order to meet the goal of raising the Trinity River water level to provide a water linkage among neighborhoods, businesses, and cultural amenities of the Central City area. It was determined that a water surface elevation of 525 msl was necessary to realize the goal of connecting the Stockyards area to other important areas. A number of alternative locations were considered and disregarded as discussed in Chapter 3 of the FEIS.

A number of locations and configurations were considered for the bypass channel, interior water feature, and the isolation gates as discussed in Chapter 3 of the FEIS. The Community Based Alternative alignment of these specific features within the river corridor was based on technical studies that provided in-depth consideration of logistics and functionality. These studies determined that there were no other reasonable alternative locations nor were their practicable alternatives to accomplish the objectives of the proposed work.

A number of areas were considered to provide hydraulic mitigation as discussed in Chapter 3 of the FEIS. 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. With no corrective action, as much as 5,250 acre feet of valley storage could be lost. Chapter 3, pages 123-124 in the FEIS discuss the evaluation of storage mitigation and explains the rationale for determining the recommended locations. 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 the Samuels Avenue Dam, and slightly downstream of the dam in the proximity to Riverside Park. Therefore, these recommended locations were determined to be the least environmentally damaging practicable alternative for hydraulic mitigation The Corps component is a subset of the Community Based Alternative and is part of the least environmentally damaging practicable alternative

The Community Based Alternative addresses all of the project objectives contained in the Trinity River Vision Master Plan referenced in the Authorization which address the four overall project purposes, i.e. Flood Damage Reduction, Ecosystem Restoration, 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 Community Based Plan is included in Chapter 3, of the FEIS. 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 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.

1.4 General Description of Fill Material

The comprehensive project consists of four primary areas: the Riverbend Hydraulic Mitigation Site; the University Drive Hydraulic Mitigation Site; the Bypass Channel Area with associated Interior Water Feature, isolation gates and Samuels Avenue Dam; and the Downstream Hydraulic Mitigation Sites. These areas are illustrated in **Figure 1**. The Corps participation component is limited to the water resources mitigation, and the previously listed hydraulic components of the Community Based Alternative. The fill characteristics within the specific areas identified in general are alluvial soils consisting primarily of clay and overlying generally fresh, unweathered limestone bedrock. This discussion is applicable to both the overall comprehensive plan and the Corps component unless otherwise noted.

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. A summary of this investigation follows. In general, the investigation found alluvial soils consisting primarily of clay and overlying generally fresh, unweathered limestone bedrock.

1.4.1 Fill Material Characteristics

A review of existing geologic data for the project area found that the geological deposits in the Fort Worth area date generally to the Cretaceous Period, during which sea levels alternately rose and fell across the area, leaving behind multiple layers of deposits (Scoggins 1993). The layers are generally thin, most are only tens of feet thick, and these formations represent several deposition environments: shallow marine, deltaic, beach, and coastal.

During the Tertiary and Quaternary Periods, the Trinity River carved out terraces through the Cretaceous deposits and deposited clays, sands, and gravel. In Tarrant County, the Paw Paw Formation, Denton Clay, Weno Limestone, Fort Worth Limestone, and the Duck Creek Formation are geologically undivided. Along the proposed bypass channel alignment, the Fort Worth Limestone and the Duck Creek Formation are overlain by alluvium. The Fort Worth Limestone and the Duck Creek Formation are both grayish to yellow-gray or yellow-brown. Both formations are limestone and difficult to differentiate. This area is within the scope of the Corps participation component.

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 and overlying generally fresh, unweathered limestone bedrock. This area is within the scope of the Corps participation component.

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 component.

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.

Site specific geotechnical explorations were not performed at each of the individual valley storage mitigation sites due to budgetary and access considerations, but the geological deposits are thought to be similar to that found in the areas investigated. The complete findings of the initial geotechnical investigation are included in Appendix B of the FEIS. These areas are within the scope of the Corps participation level.

1.4.2 Fill Classification

Fill operations for the comprehensive project have been segregated into four classifications based on nature of the fill 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 in **Figure 2**. These classifications are applicable to both the overall comprehensive plan and the Corps participation component unless otherwise noted.

Embankment fill. Material placed above the ordinary high water mark and outside of the existing riverine system. Portions of the fill material would be within the Standard Protection Flood (SPF) and/or 100-yr floodway. Embankment fill that would be conducted within the SPF or 100-yr floodplain would be compensated by other project related excavation activities.

Out-of-bank fill. Material that is placed completely outside the existing riverine system. This material would be placed outside the SPF or 100-yr floodway.

Levee fill. Material generally to be placed above the ordinary high water mark and adjacent to the existing riverine system and/or proposed bypass channel and used to control floodwaters. Levee fill is to be placed adjacent to the flood isolation gate structures with some materials placed below the ordinary high water mark. Levee material would be placed within the SPF or 100-yr floodway.

In-channel fill. Material that is placed below the ordinary high water mark within the existing riverine system. This material would be placed in a controlled manner with erosion control facilities in place to protect adjacent aquatic areas. Placement would occur primarily in the “dry” by using coffer dams to segregate these areas prior to fill operations. There is less fill associated with the in-channel fill occurring in the Corps participation component.

Temporary fill. Material that is placed below the ordinary high water mark and within the 100-year floodplain in order to facilitate construction of the project (e.g., fill associated with cofferdams) and which will be removed after construction is complete.

1.4.3 Fill Quantities

Approximately 4.4 million cubic yards (CY) of material are anticipated to be excavated and discharged as part of the Central City Project. In addition, approximately 200,000 cubic yards of material which will form permanent structures 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 memo. Preliminary earth work volume calculations for the currently proposed bypass channel, adjacent work areas, and valley storage mitigation sites are summarized in **Table 1**.

1.4.4 Source of Fill Material

The fill material for the comprehensive FWCC project would be generated from excavation activities associated with the project or from the placement of structures within the waterway. Sources would be the same for both the overall comprehensive plan and the Corps limited participation component. The primary sources of fill material would be from the excavation of the Corps portion of the overall project as follows: bypass channel and construction of the valley storage mitigation sites shown in Figure 1. The bypass channel is approximately 8,400 ft long and consists of both cut and fill. Excavated material from the channel section would be used as the material source to construct the new levee (west) and out-of–bank area behind the retaining walls (east) on either side of the bypass channel. Excess excavated material from the bypass channel would be used as the fill source for the University Drive hydraulic mitigation site.

The valley storage mitigation sites shown on **Figure 3** are the other primary source of fill material. Excavated materials at both the Riverbend and Downstream hydraulic mitigation sites would be reused as fill at the same sites. Excavation of the preliminary interior water feature as shown on **Figure 3** would also provide fill for the bypass channel out-of-bank area and in-channel fill. **Table 2** provides a summary of the preliminary excavation volumes from each of the fill material source locations.

1.5 Proposed Discharge Sites

For documentation purposes, the discharge sites which are applicable to both the overall comprehensive project and the Corps participation component were grouped into four general locations as shown in **Figure 4** and described below. **Figure 4** also illustrates which of the fill discharges areas are generally within the 100-year floodplain.

1.5.1 Riverbend Hydraulic Mitigation Site

The Riverbend Hydraulic Mitigation Site, located along the West Fork, Trinity River upstream of White Settlement Road, is currently protected by an existing levee located on the eastern bank that runs the entire length of the proposed site. The site is undeveloped and primarily flat, consisting of grasslands with some medium to dense woody vegetation. The site is approximately 290 acres of which 215 acres are proposed to be impacted directly by the project.

The Riverbend Hydraulic Mitigation Site is currently located outside of the 100-yr floodplain; however, use of the site for valley storage mitigation would remove portions of the existing levee which currently protects this site. Use of the site for discharge is necessary to accommodate site preparation and ecosystem restoration activities. Proposed grading on the site includes the construction of a levee on the eastern and southern sides

of the site and excavation of drainage swales and lowlands for ecosystem restoration. Grading plans are included in Appendix C of the Final EIS.

All excavated material would be retained on site. A total of approximately 70 acres of this site would be used for discharge of material excavated from onsite for purposes including approximately 30 acres of new levee construction and 40 acres of embankment fill. Fill materials would be kept from entering the existing river during construction by appropriate erosion control practices. Prior to the removal of the erosion control practice all exposed areas would be vegetated and stabilized.

The bulk of the excavation and discharge work on this site is intended to be completed and stabilized prior to the use of this site for valley storage. Sequencing of the work would delay discharge of excavated material into the existing aquatic environment until the new levee and embankment are vegetated and stabilized.

1.5.2 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 24 acres in size of which 10 acres are roadway right-of-way and the remaining property is commercial.

Use of the University Drive Mitigation Site as an excavated material discharge site within the 100-yr floodplain is a key component in mitigating the loss of floodplain or valley storage. Site work would include raising the existing roadway profile and filling the adjacent commercial properties to provide access to the raised roadway.

Construction of the University Drive embankment would occur outside the existing riverine system but within the 100-yr and SPF floodplain. Disturbed sites including areas of fill would be protected 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 component.

1.5.3 Bypass Channel/ Trinity Uptown Site

Construction within the Bypass Channel/Trinity Uptown site would be done to meet project goals of providing a catalyst for economic expansion into the area adjacent to downtown Fort Worth and to provide a linkage to the existing Stockyards area. As such it is the area of the largest activity including excavation and discharge of fill material. 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. Fill in this area would be of several fill classifications.

The placement of in-channel fill (Figures 2 and 4) covers approximately 35 acres. This feature is associated with the overall comprehensive plan but the fill would not be included in the Corps participation component. As a result of this fill the channel depth within the Interior Water Feature would vary between 10 and 15 feet. Additional fill within the area outside of the existing 100-year floodplain is necessary to prepare for the proposed redevelopment within the Trinity Uptown area. The earthwork-related fill associated with the interior water feature of the Community Based Plan is necessary to maximize recreational and aesthetic uses of this water feature. The structures associated with the three isolation gates will result in approximately 280,000 cubic yards of permanent fill. This portion of the comprehensive plan is part of the Corps participation component. Thus the 280,000 cubic yards of permanent fill is reviewed both comprehensively as but clarified to be impacts of the Corps participation based on the fill associated with the interior water feature and the isolation gates.

Levee fill is proposed on the west side of the bypass channel and adjacent to the TRWD and Clear Fork gate structures. Out-of-bank fill would be placed behind the hard edge retaining walls on the east side of the bypass channel and for the White Settlement Road and Henderson Street Bridge roadway approaches. This impact is not part of the Corps participation in the project.

The majority of excavation and fill operations associated with the construction of the bypass channel would occur prior to the full use of the bypass channel to convey floodwaters. Precise sequencing of excavation and fill activities, including location and size of temporary coffer dams, would occur as a part of final design. Temporary coffer dams are anticipated near each of the three proposed isolation gates (Clear Fork gate, Trinity Point gate, and TRWD gate) and preliminary estimates anticipate approximately 35,000 cubic yards of temporary fill for this purpose. This temporary fill is an impact of the Corps participation component.

The Samuels Avenue Dam structure located downstream of Samuels Avenue would result in approximately 30,000 cubic yards of permanent material being placed into the West Fork of the Trinity River and adjacent floodplain. In addition, Samuels Avenue Dam would impound water to an elevation of 525 feet 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. 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 temporary coffer dams, would occur as a part of final design. A temporary coffer dam is anticipated for the construction of Samuels Avenue Dam and preliminary estimates anticipate approximately 15,000 cubic yards of temporary fill for this purpose. In addition, a temporary bypass channel would possibly be excavated on the right bank of the floodplain if need to allow for construction of Samuels Avenue Dam. This borrowed material would be stored temporarily outside the floodplain and used after completion of Samuel Avenue Dam to restore the temporary bypass excavation.

All disturbed sites associated with excavation and discharge of fill materials would be protected during construction by appropriate erosion control practices. 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 component.

1.5.4 Downstream Hydraulic Mitigation Sites

The Downstream Hydraulic Mitigation Sites, as shown on **Figure 4**, located along the West Fork downstream of Samuels Avenue, are within the current floodway. The sites are undeveloped and primarily flat, consisting of grasslands with some medium to dense woody vegetation in some locations. The total fill discharge areas for these sites cover approximately 60 acres and consist of both embankment and out-of-bank fill classifications.

All excavated material from the hydraulic mitigation sites would be retained on these sites. The embankment fill area (approximately 35 acres) is adjacent and on top of an existing landfill. Levee fill (approximately 6 acres) would be placed upstream of the Samuels Avenue dam on either side of the West Fork to control flow through the dam structure and maintain the normal pool elevation. The out-of-bank fill area (approximately 18 acres) consists of filling an old impound lot and is located outside of the existing floodway. These impacts are within the scope of the Corps participation component of the project.

All disturbed sites would be protected during construction by appropriate erosion control practices. Prior to the removal of the erosion control practice employed all exposed areas would be permanently vegetated or

otherwise stabilized.

1.6 Description of Discharge Method

The discharge of 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 discharge site where scrapers are infeasible or uneconomical based on haul distances. Excavated material would be sorted and handled on site prior to placement in the designated discharge area. Excavated material would be placed in suitable lifts and compacted as required for structural and soil stability design criteria. Contaminated material would be hauled by truck to appropriate landfills for discharge if not acceptable for use on the project.

2.0 Factual Determinations

The factual determinations are applicable to both the overall comprehensive plan and the Corps component 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 component.

2.1.2 Sediment Type

No previous sediment transport studies in the Trinity watershed reaches potentially affected by the FWCC project were found which includes the Corps portion of the FWCC. 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 FWCC 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 large rip-rip 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 would have direct impact on the area of fill and would have additional temporary effect on the areas that would be dried prior to construction of the gates, Samuels Avenue 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 reflooded. 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 inchannel 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 1875 feet of Marine Creek there would be a shift from benthic organisms characteristic of flowing water habitat to those adapted to more lake-like conditions. In addition, benthic habitat would be permanently lost in the lower 400 feet of Lebow Creek due to filling of the channel. Rerouting the confluence of Lebow Creek to downstream of Samuels Avenue Dam would offer the opportunity to create habitat suitable for benthic organisms adapted to flowing water in the new 1200 foot channel. 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 component of the project.

2.1.5 Other Effects

None.

2.1.6 Actions Taken to Minimize Impacts

Efforts were 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 would incorporate flow augmentation to sustain benthos and associated fisheries in LeBow Creek has been developed and will be further defined during the first year of the design phase. Additional benthic habitat structure will also be developed in LeBow Creek upstream of the filled channel and in the new rerouted segment. Additional aquatic habitat mitigation will be 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.

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, instream 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. Full discussion of the modeling results are included in the EIS.

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 component.

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 component.

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. These odors could be associated with increased levels of hydrogen sulfide. Any additional odor problems would be of short duration and are not expected to be a significant problem. The potential for temporary odor changes are within the scope of the Corps participation component.

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. The Corps participation component would not cause any significant changes of Dissolved Oxygen concentration levels.

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 and it is no additional eutrophication is anticipated from proposed changes to the system. These potential impacts are within the scope of the Corps participation component because the dam creates the lakes even though this is not a direct element of the Corps participation component.

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 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 Riverbend and University Drive Hydraulic Mitigation improvements. 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 slackwater situation 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). Hydrologic Regime major flow changes during storm events would be within the scope of the Corps participation.

2.2.2.2 Current Pattern and Flow

The flow supply to the Trinity Uptown area would continue in much the same quantity as under current conditions. After construction of the bypass channel, circulation in the system would be altered. This alteration is within the scope of the Corps participation.

2.2.2.3 Velocity

Under existing conditions, velocity varies from approximately 4.6 feet per second in the vicinity of fourth street dam to 11.6 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 ft/s 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. The Corps participation component 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 component of this project.

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 (TRWD 2005). Results of this analysis are discussed in detail in the Central City Environmental Impact Statement. 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 component. 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 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 channels 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 component.

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. This option is outside the scope of the Corps participation component.

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 protocols. 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 well above the State of Texas standard of 5 mg/L. These changes discussed are impacts that are within the scope of the Corps participation component.

2.3.2.3 Toxic Metals and Organics

The State of Texas listed one mile of Segment 0829 (Clear Fork Trinity River below Benbrook Lake) upstream of its confluence with the West Fork, as not meeting water quality standards because of high levels of chlordane in fish tissue. This designation requires the development and implementation of a Total Maximum Daily Load (TMDL) process specific for that waterway and pollutant.

The Texas Commission on Environmental Quality (TCEQ) has prepared an implementation document 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). Existing evaluations indicate there is no known reason why the proposed project would increase the likelihood of chlordane in the waterway. However, 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 the Corps participation component.

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

Currently, the State of Texas river segments of the Trinity River encompassed by the proposed project, Segments 0806 and 0829, meet the State water quality standards for bacterial indicators (E. coli and fecal coliforms). The project would not induce new sources of pathogens and therefore the proposed project would not cause these standards to be exceeded.

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 component. The 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 2004 Texas Water Quality Inventory" (TCEQ, 2004) 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 1996-2001 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 a 2002 algal 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 Community Based Alternatives 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) 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 Community Based Alternatives 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. These actions will be taken for the Corps participation component as well as the overall comprehensive 435M project.

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 component 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 component.

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, 1875 linear feet of exceptional and high quality aquatic habitat within Marine Creek would be adversely impacted as a result of inundation effects of Samuels Avenue Dam. In addition, filling of the lower segment of Lebow Creek would adversely impact about 400 linear feet of exceptional quality aquatic habitat. The effects of significance would be from the loss of riffle pool complexes for both Creeks. Other adverse impacts to wetlands and riparian forest habitat would occur from construction of the project. As further identified in the Central City EIS, the project would impact 11.7 acres of wetlands but would only impact 1.60 average annual habitat units (aahus)as compared to the without a project future conditions. In addition the comprehensive Community Based Plan and Trinity Uptown Features would impact about 35.7 acres of riparian forest having 18.36 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 component 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 Riverbend Hydraulic mitigation site. Riparian forest development and management would provide a net gain of 41.47 AAHUs of riparian forest over the 18.36 aahus lost as a result of the project. Approximately 15.02 acres of wetlands would be provided at the same site that would result in the ultimate provision of 13.78 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 15.02 acres of wetland, 13.78 AAHU's and the net gain of 41/47 AAHU's are within the scope of the Corps participation component.

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 mitigate the impacts caused by inundating 1875 linear feet of exceptional and high quality Marine Creek lentic aquatic

habitat and filling of approximately 400 linear of exceptional quality LeBow Creek aquatic habitat as result of implementing the Community Based Alternative. Mitigation measures under evaluation include diverting flows, varying by season up to 5 cubic feet per second, to the mid-reach of Lebow Creek. A gravity flow pipeline from the Samuels Avenue Dam would be possible to a point on the stream where the bottom elevation is approximately 525 feet, which appears to be near Brennan Avenue. In addition, investigation of the potential to add additional aquatic habitat area by modifying the channel bottom of Lebow Creek within the reach downstream of Brennan Avenue including the 1500 feet of the new rerouted channel. This mitigation plan is within the scope of the Corps participation component.

Additional aquatic mitigation at Ham Branch 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 G. The aquatic mitigation at Ham Branch is within the scope of the Corps participation component.

Development of a riparian forested buffer of 50 foot in width on either side. 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 component.

Water quality improvement, if found necessary to benefit aquatic habitat resources development, would be provided by construction of small off channel wetlands. An area has been identified that could provide approximately 0.6 acres of emergent wetlands. In addition, a triangular shaped area between existing railroads at the outfall draining downtown Fort Worth could be modified to develop up to approximately 0.7 acre of sediment- and floating materials-trap if needed. This improvement if necessary would be mitigation within the scope of the Corps participation component.

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 without project conditions. Stream habitat alternations proposed within Lebow Creek and Ham Branch should provide a combined 1.52 AAHU over without project conditions thereby compensating for unavoidable impacts to Marine Creek and lower Lebow Creek. 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.

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 component.

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 EIS. 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 know reasonably foreseeable actions within the geographic area. Significant direct impacts to wetlands, riparian woodlands and the stream habitat of Marine Creek and Lebow 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 EIS. 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 component which is a portion of the 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 this EIS 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 EIS. 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 component.

3.0 Findings of Compliance For Fort Worth Central City

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

3.2 The No Action and P&G alternatives analyzed in the EIS 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 Community Base alternative 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.

3.3 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.

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

3.5 The comprehensive community Plan alternative which includes the Corps participation component would not violate terms and conditions of the CDC or Trinity Regional EIS ROD for preventing cumulative impacts to hydrologic resources.

3.6 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 component of mitigation were not completed the proposed discharge could potential have adverse impacts to human health and welfare, recreational fishing, plankton, fish, shellfish, wildlife and special aquatic sites.

3.7 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 component.

3.8 On the basis of the guidelines the proposed disposal sites for the discharge of dredge material is specified as complying 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 the analysis reviews 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 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

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5.0 Attachments

Table 1: Preliminary fill quantities

Description	Volume (cu. yd.)	Volume (cu yd) within 100-year floodplain
Embankment Fill	1,518,000	835,000
Levee Fill	1,130,000	515,000
Out-of-bank Fill	1,565,000	0
In-Channel Fill	310,000*	310,000*
Temporary Fill	50,000	50,000
Total	**4,573,000**	**1,710,000**

* approximately 50 percent earth work, 50 percent structures, only approximately 255,000 Cubic Yards of in-channel fill is within the scope of the Corps participation component.

Table 2: Preliminary excavation quantities

Description	Volume (cu. yd.)
Riverbend Hydraulic Mitigation Site	1,262,000
Bypass Channel	1,585,000
Interior Water Feature	485,000
Downstream Mitigation Sites*	1,241,000
Total	**4,573,000**

* includes all excavation associated with Samuels Ave Dam including Lebow Creek redirect

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

Source: Texas Commission on Environmental Quality Chapter 307: Texas Surface Water Quality Standards

Table 4: Water surface elevations at specified stations along the Trinity River.

Station	Existing Conditions Median flows	Annual average flows	2-yr	10-yr	100-yr
237615	500.7	501.3	511.1	517.5	522.9
243471	500.7	501.3	512.1	518.7	525.1
280042	520.2	521.2	539.6	544.7	549.7
Station	**Proposed Conditions** **Median flows**	**Annual average flows**	**2-yr**	**10-yr**	**100-yr**
237615	500.7	501.3	511.1	517.5	522.9
243471	524.3	524.3	512.4	518.8	525.0
280042	524.3	524.4	539.5	544.6	549.7