

CHAPTER 1.0
INTRODUCTION

CHAPTER 1 - INTRODUCTION

1.1 Study Scope and Area

The Scope of the program is flood damage reduction and ecosystem restoration projects in the lower Colorado River basin, Texas. Projects could be implemented by U. S. Army Corps of Engineers (USACE) through congressional authorization or the Continuing Authorities Program. Projects that are large in scope require specific Congressional authorization; however, in instances where problems are generally small in scope, USACE may act directly under its Continuing Authorities Program.

The study area addressed herein includes the lower Colorado River watershed from O.H. Ivie Reservoir downstream through the Highland Lakes to the mouth of the river at Matagorda Bay. The lower Colorado River basin encompasses about 18,300 square miles of contributing drainage area (Figure 1-1). The total length of the lower Colorado River studied for this project is 482 miles. The lower portion of the basin contains several major tributaries to the Colorado River, most notably the Llano River, Pedernales River, San Saba River, Pecan Bayou, Sandy Creek, and Onion Creek. The dam at O.H. Ivie Reservoir was chosen as the beginning of the study area since it represents the upstream limit of any project related impacts. The Programmatic Environmental Impact Statement (PEIS) is not intended to cover any projects upstream of O.H. Ivie Reservoir.

1.2 Study Authority

Feasibility studies for the lower Colorado River basin have been and are being conducted by USACE in response to direction by the Congress of the United States from which USACE derives Federal funding for the studies. The authority for the studies of the Colorado River, Texas and tributaries include but are not limited to:

Flood Control Act, approved June 22, 1936:

“Section 6. The Secretary of War is hereby authorized and directed to cause preliminary examinations and, surveys for flood control at the following named localities...Colorado River, Texas, above the county line between Coke and Runnels counties...lower Colorado River, Texas.”

Resolution by the Committee on Commerce, United States Senate, adopted August 4, 1936:

“Resolved by the Committee on Commerce of the United States Senate, that the Board of Engineers for Rivers and Harbors created under Section 3 of the River and Harbor Act, approved June 13, 1902, be and is hereby, requested to review the reports on Colorado River, Texas, submitted in House Document Number 361, Seventy-first Congress, second session, and previous reports, with a view to determining if improvement in the interest of commerce and flood control is advisable at the present time.”

Rivers and Harbors Act, approved August 26, 1937:

“Section 4. The Secretary of War is hereby authorized and directed to cause preliminary examinations and surveys to be made at the following named localities...Colorado River, and its tributaries, Texas, with a view to its improvement in the interest of navigation and flood control.”

Rivers and Harbors Act, approved March 2, 1945:

“Section 6. The Secretary of War is hereby authorized and directed to cause preliminary examinations and surveys to be made at the following named localities...Colorado River, Texas.”

Onion Creek Authorization

Specific authority for the study of Onion Creek is contained in a resolution by the Committee on Transportation and Infrastructure, United States House of Representatives, adopted May 6, 1998, and is quoted below:

“Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, that the Secretary of the Army is requested to review the report of the Chief of Engineers on the Colorado River, Texas, published as House Document 361, 71st Congress, 2nd Session, and other pertinent reports, with a view to determine if improvements to the Onion Creek watershed in the interest of flood damage reduction, environmental restoration and protection, and other related purposes are advisable at the present time.”

Continuing Authorities Program

In addition to specific Congressional authorization, projects can be implemented through the Continuing Authorities Program, which allows USACE to respond more quickly than is pos-

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sible through the specific Congressional authorization process. Congress has delegated to USACE the general authority to study, approve and construct certain water resources development projects. The program is comprised of different types of projects, each with its own project authority and strict limit on the Federal contribution. As favorable studies progress toward more detailed design and construction, certain project costs must be shared with the local sponsor including any and all costs in excess of Federal project limits. For this reason, the local sponsor must be a non-Federal entity with the power to raise revenue sufficient to satisfy requirements of local cooperation.

Section 14 of the Flood Control Act of 1946 provides for the development and construction of emergency streambank and shoreline protection projects to protect endangered highways, highway bridge approaches, public works facilities, churches, schools, hospitals, and other non-profit public facilities.

Section 205 of the Flood Control Act of 1948 provides for local protection from flooding by the construction or improvement of structures such as levees, channels, and dams. Non-structural alternatives may include measures such as installation of flood warning systems, raising and/or flood proofing of structures, and relocation of flood-prone facilities.

Section 206 of the Water Resources Development Act of 1996 provides for the restoration and protection of aquatic ecosystems if the project will improve the environment and is in the public interest.

Section 208 of the Flood Control Act of 1954 provides for local protection from flooding by channel clearing and excavation, with limited embankment construction.

Section 1135 of the Water Resources Development Act of 1986 provides for ecosystem restoration through modification to structures or operation of USACE structures or implementation of restoration features when the construction of a USACE project has contributed to degradation of the quality of the environment.

1.3 Purpose and Need

Previous studies conducted along the lower Colorado River by USACE and others (USACE 1961, 1971, 1975, 1979, 1981a, 1981b, 1985a, 1985b, 1986a, 1986b, 1987a, 1987b, 1987c, 1987d, 1988, 1989a, 1989b, 1990, 1991a, 1991b, 1992, 1995, 2003a; Loomis & Moore 1997) have concluded that significant flood risks exist along the main stem of the river as well as some of its tributaries in the Austin area. In response to requests for assistance from the City of Austin (COA), the State of Texas and the Lower Colorado River Authority (LCRA), the Congress of the United States autho-

rized funding to USACE to conduct the Lower Colorado River Basin Study (LCRBS). The LCRA acts as the non-Federal cost sharing sponsor with USACE, on behalf of other local entities that to date include the cities of Austin, Sunset Valley and Wharton, Travis County and the Texas Water Development Board (TWDB). These latter entities serve to sponsor interim feasibility studies that are focusing on their respective problem areas to reduce flood damages, restore and protect environmentally sensitive areas, improve water conservation, and provide recreational opportunities.

From USACE's perspective, key Federal concerns for the nation's water and related land resources lie in controlling and minimizing urban flood damages, enhancing navigation, and protecting and restoring the environment. Prevention of agricultural flood damages, intensification of agricultural crop yields, development of hydropower, water supply, and recreation are additional purposes, which could be incorporated into a multipurpose project that has flood damage reduction, navigation, and/or ecosystem restoration as the primary purpose. Therefore, initial efforts focused on identifying potential flood prone areas within the lower Colorado River basin to determine if key Federal interest existed that warranted further studies.

During the initiation of the LCRBS, a group of local communities and interests came together to form the Texas Colorado River Floodplain Coalition (TCRFC). This group of over 50 communities and counties within the lower Colorado River basin was formed to encourage comprehensive consistent management of the floodplain along the Colorado River and its tributaries; provide a forum for data exchange and facilitate a structured approach to managing the complex issues related to floodplain management. The TCRFC has provided invaluable input to the study and support for budgetary and TWDB grant application requests by the study sponsor communities.

Phase I investigations of the LCRBS (USACE 2003b) focused on identifying existing conditions within the basin regarding flood damages to residential, commercial, industrial and public structures, environmental conditions, opportunities for restoration of natural ecosystems, and recreational needs. Based on the results of previous studies, the high cost of conducting additional studies and the identification of cost sharing sponsors, the Phase I study area was limited to the main stem of the river. Tributary areas will be addressed during their respective interim feasibility studies or as other potential sponsors emerge.

The Onion Creek Interim Feasibility Study is currently underway for Onion Creek in the cities of Austin and Sunset Valley and Travis County. The Wharton Interim Feasibility Study is currently underway in Wharton, Texas, and the Highland Lakes Interim Feasibility Study is also currently underway. These interim studies are focusing on known problem areas that were identified

during past studies and confirmed during a reconnaissance study. Two additional interim feasibility studies are known to be forthcoming: one each for the Walnut Creek and Shoal Creek watersheds in the COA. These interim feasibility studies constitute Phase II of the LCRBS.

Concurrent with the Phase II interim feasibility studies, and prior to the completion of any one of them, Phase III studies are being conducted to establish existing baseline conditions and adequately assess cumulative impacts that would result from implementing the interim feasibility studies. The PEIS is the final product of the Phase III studies. The PEIS will serve as a springboard for tiering the future environmental analysis of any recommended implementation plan that is a product of an interim feasibility study or future USACE recommended multipurpose flood damage reduction or ecosystem restoration study within the lower Colorado River basin.

1.4 National Environmental Policy Act Requirements

This document has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended, and guidance contained in pertinent implementing regulations. NEPA is the primary legislation that sets forth regulations for the consideration of environmental consequences in the decision-making process of proposed major Federal Actions. Title II of this act created the Council on Environmental Quality (CEQ) and in 1978 the CEQ issued regulations (40 CFR Parts 1500-1508) which established statutes for implementing the provisions of NEPA. This PEIS serves to fulfill the requirements of NEPA and pertinent USACE regulatory guidance for implementing the procedural provisions of NEPA found in Engineer Regulation (ER) 200-2-2 dated 3 February 1988.

NEPA regulations direct agencies to use PEISs and tier from statements of broad scope to those of narrower scope to eliminate repetitive discussions of the same issues. In addition, the scope for an Environmental Impact Statement (EIS) directs agencies to group together actions of several types:

- Connected actions, i.e. actions that are closely related and automatically trigger other actions that may require an Environmental Assessment (EA) or EIS.
- Cumulative actions, i.e. actions that may have cumulatively significant impacts when evaluated in conjunction with other proposed actions.

- Similar actions, i.e. actions that, in conjunction with other proposed or reasonably foreseeable agency actions, have common elements that provide a basis for evaluating their consequences together. Similar actions may be grouped based on relevant characteristics such as timing, geographical location, impacts, alternatives, methods of implementation, media or subject matter.

As the lead agency responsible for implementing flood damage reduction measures and protecting and restoring the natural environment for the nation's water and related land resources, and because the proposed action consists of a large-scale program of multiple individual projects within the basin, USACE has determined that a PEIS is the appropriate document for assessing the anticipated impacts associated with these activities. On July 31, 2001, USACE published a Notice of Intent (NOI) to prepare a Draft PEIS (DPEIS) for potential multi-objective projects in the lower Colorado River basin and associated tributaries for flood damage reduction, ecosystem restoration, and recreation in and around Austin, Texas. A copy of the NOI can be found in Appendix 1.

The actions to be evaluated in this PEIS are the direct, indirect, and cumulative environmental impacts of USACE activities within the lower Colorado River basin, combined with the reasonably foreseeable activities of others that would affect the lower Colorado River basin. This programmatic evaluation also helps to assure that a holistic approach is taken to addressing the water related problems and opportunities within the watershed.

Generally, a PEIS contains significantly less detail than an EA or EIS for a specific project, and usually does not involve complex quantitative analyses. Because a PEIS is broad in scope, additional environmental impact analyses are often required for certain individual activities in cases where sufficient detail was not available to adequately assess the environmental impacts as part of the programmatic process. Subsequent EAs or EISs can be tiered to the PEIS and need only reference the PEIS and summarize relevant issues, allowing the EA or EIS to concentrate on the impacts of the specific action that it addresses.

Consistent with CEQ regulations, the scope of the analysis presented in the PEIS defines the potential range of environmental impacts that may result from implementation of the proposed actions. This PEIS addresses alternatives evaluated to address flood damage reduction and ecosystem restoration in the study area, and discloses the direct, indirect, and cumulative impacts of these potential projects, along with those past, present, and reasonably foreseeable future projects, to the

extent that they could be determined.

Reasonably foreseeable future projects were identified through agency scoping and the public involvement process. Three agency scoping meetings were conducted with various state and Federal resource agencies. Over 800 letters were mailed to potentially affected individuals and local and county officials in an effort to identify proposed future projects and concerns. Three public scoping meetings were held in September 2003 to solicit public input and identify upcoming projects proposed within the study area.

1.5 Public Concerns

In order to facilitate public involvement, elicit public comment, identify reasonably foreseeable future projects, and coordinate as required by the NEPA process, public scoping meetings were held on September 16, 2003 near Buchanan Dam, Texas; September 17, 2003 in Bastrop, Texas; and September 18, 2003 in Bay City, Texas. During the public scoping process, a number of comments were received. These issues generally related to preservation of environmental quality, along with protection of life and property from flood damages and cleanup of damaged property from previous flooding episodes. Additionally, concerns were expressed over the effects of the high rate of development and increasing impervious cover in the watershed. Finally, concerns were expressed over the proposed projects increasing water surface elevations in Matagorda County. A more detailed discussion of the public involvement process is presented in Chapter 8.

1.6 Study Objectives

The purpose of this PEIS is to develop a document from which other project-specific environmental documents within the basin can be tiered. The objectives of the programmatic document are to 1) address the programmatic effects of potential projects proposed by USACE, 2) provide an overview of the existing environmental conditions within the basin, 3) identify reasonably foreseeable projects of others, and 4) address cumulative impacts of the proposed action in combination with the past, present, and reasonably foreseeable projects of others. Additionally, a Geographic Information System (GIS)-based data management system is being developed that will allow USACE and LCRA to access all relevant data and reference documentation in an organized, digitized manner after completion of the PEIS.

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CHAPTER 2.0
PROPOSED ACTION AND ALTERNATIVES

CHAPTER 2 - PROPOSED ACTION AND ALTERNATIVES

2.1 No Action Alternative

Section 1502.14(d) of NEPA regulations requires the alternatives analysis in an EIS to “include the alternative of no action.” Under the No Action Alternative, USACE would not recommend funding for the flood damage reduction and ecosystem restoration projects in the LCRBS. No USACE structural or non-structural flood damage reduction measures or ecosystem restoration measures would be constructed under the LCRBS, and structures would remain within the 100-year floodplain. However, to the extent that they are known, other planned activities by USACE, LCRA, other state and local agencies, and private development would occur under the No Action Alternative. The following is a general description of the likely future conditions in the lower Colorado River basin under the No Action Alternative.

From 1950 to the present, there has been a 197% increase in the number of people living within the lower Colorado River basin. The average annual growth rate during this period was 2.4% (Lower Colorado River Planning Group 2000). The majority of future population growth in the basin is expected to occur in the Austin metropolitan area. Although population growth is anticipated to stabilize over the next 50 years in Travis County, the remaining counties within the Austin metropolitan area are expected to grow rapidly, and the overall population of the Austin metropolitan area will double by 2050 (TWDB 2004). Average annual growth rates in the remainder of the basin are expected to be near 0% during the next 30 years, with some counties in the northwestern portions of the basin experiencing a negative growth rate (TWDB 2002).

Outside of the Austin metropolitan area, agriculture, forest, and rangeland will continue to be the major land uses in the future and much like the current setting, these three land use classifications will continue to comprise nearly 95% of the land uses in the basin. Manufacturing, retail trade and services, government, and construction are currently the largest employers in the region. However, service, health, and technology sector growth in the study area are expected to follow nationwide trends as older and more affluent sections of the region’s population grow.

Several USACE navigation projects are currently well underway that are outside the scope of this PEIS and will have their own NEPA documentation. These projects are listed below.

- Matagorda Bay Reroute Navigation Project
- Gulf Intracoastal Waterway (GIWW) Modification Study on the Colorado River Locks Navigation Project

- Mouth of the Colorado River Navigation Project
- Matagorda Ship Channel Reevaluation Study

The LCRA has two other proposed projects in the basin. These projects are the LCRA/San Antonio Water System (SAWS) project and the LCRA Water Management Plan described in detail in Sections 5.1.2 and 5.3. It is anticipated that all of these projects would be implemented under the No Action Alternative. The COA has numerous water quality, flood and erosion protection, channel stabilization and channel improvement projects, road and bridge upgrades and replacements, and buyouts of flood-prone structures within the basin. These projects are summarized in Table 5-1 in Section 5.3 and it is assumed that they all would be implemented under the No Action Alternative. The Texas Department of Transportation (TxDOT) has 18 road and highway upgrade and bridge replacement projects within the basin (as described in Table 5-2 in Section 5.3). The No Action Alternative assumes that all of these transportation projects will be implemented in the future.

Other projects proposed within the basin that would be implemented in the future under the No Action Alternative are new surface water strategies, directed under the authority of Senate Bill 1, by Regional Water Planning Groups to address future unmet water supply needs in Texas. It has been projected that at least two major water providers in the lower Colorado River basin, 30 water user groups, and Travis County will have additional water supply needs by 2050. As described in Section 5.3, it is projected that new surface water, existing surface water, reuse, conservation, new groundwater, and new interbasin transfers will be used to meet these needs by 2050. The City of Pflugerville Water Supply project is currently under construction and, for purposes of this document, is considered to be an existing facility including a reservoir in the Brazos River basin with a water intake on the Colorado River below Town Lake to provide water to the storage reservoir. Future plans call for increasing the amount of water taken from the Colorado River from 12,000 acre-feet (ft)/yr to 18,000 acre-ft/yr. Furthermore, the Austin-Bastrop River Corridor partnership would provide guidance, contribute to community awareness, and support conservation and restoration within the Austin-Bastrop Colorado River corridor. In total, it is anticipated that up to 101 water resources, flood control, ecosystem restoration, navigation, recreation, and transportation projects would occur during the planning horizon for this study within the lower Colorado River basin, as described in Chapter 5. Additionally, private sector development will continue including the construction of housing and commercial development, especially in the growing Austin metropolitan area. Furthermore, ongoing sand and gravel mining in the lower Colorado River basin is anticipated to increase.

2.2 **Proposed Action**

The Proposed Action would implement all USACE recommended future flood damage reduction and ecosystem restoration measures within the lower Colorado River basin including the interim feasibility studies described in the LCRBS and two Section 206 projects. The interim feasibility studies are the Highland Lakes, Shoal Creek, Walnut Creek, Onion Creek, and Wharton. Section 206 studies are the Mad Island and Austin Area Lakes. In addition the Proposed Action includes any combination of structural, non-structural, and ecosystem restoration measures at different scales (e.g. length of levees; size and number of detention basins) to serve as a future project or as multiple projects.

Highland Lakes Interim Feasibility Study: The Highland Lakes Interim Feasibility Study is a multipurpose flood damage reduction, ecosystem restoration, and recreation study focusing on solving the flooding problems in the Highland Lakes, specifically Lake Travis. The non-Federal sponsor is the LCRA.

Shoal Creek Interim Feasibility Study: The Shoal Creek Interim Feasibility Study would be a multipurpose flood damage reduction, ecosystem restoration, and recreation study focusing on solving the flooding problems on Shoal Creek in the COA. The non-Federal sponsors are the LCRA and the COA.

Walnut Creek Interim Feasibility Study: The Walnut Creek Interim Feasibility Study would be a multipurpose flood damage reduction, ecosystem restoration, and recreation study focusing on solving the flooding problems on Walnut and Little Walnut creeks in the COA. The non-Federal sponsors are the LCRA and the COA.

Onion Creek Interim Feasibility Study: The Onion Creek Interim Feasibility Study is a multipurpose flood damage reduction, ecosystem restoration, and recreation study focusing on solving the flooding problems on Williamson and Onion creeks in and around the COA. The non-Federal sponsors are the LCRA, cities of Austin and Sunset Valley, and Travis County with financial support from the TWDB.

Wharton Interim Feasibility Study: The Wharton Interim Feasibility Study is a multipurpose flood damage reduction, ecosystem restoration, and recreation study focusing on solving the flooding problems in the City of Wharton. Ecosystem restoration and recreation features would only be implemented if it is a secondary use of lands purchased for flood damage reduction. The

non-Federal sponsors are the LCRA and City of Wharton with financial support from the TWDB.

Mad Island Section 206: Mad Island is an aquatic ecosystem restoration project designed to protect approximately 7 miles of GIWW shoreline fronting Texas Parks and Wildlife Department (TPWD) 7,200 acre Mad Island Wildlife Management Area (WMA) and The Nature Conservancy's (TNC) 7,063 acre Mad Island Marsh Preserve. The current plan calls for a rock revetment from Culvers Cut westward to Mad Island Cut constructed from C-stone approximately 220 ft from the centerline of the GIWW. The preserves contain a range of fresh to saline marshes, submerged aquatics, freshwater lakes and the northernmost extent of Tamaulipan scrub-shrub vegetation. The non-Federal sponsor is TNC.

Austin Area Lakes Section 206: The Austin Area Lakes Section 206 is an aquatic ecosystem restoration study in very preliminary stages that would restore native aquatic vegetation within Lake Austin and Town Lake in the COA. The COA would be the non-Federal sponsor for this study.

2.2.1 Flood Damage Reduction Alternatives

General USACE flood damage reduction projects usually include structural and non-structural measures. In addition, ecosystem restoration or recreational features may be added to projects. Structural measures may include one or a combination of levees, floodwalls, relief channels, diversion channels, tunnels, dry detention basins, multipurpose reservoirs, detention basins and channel improvements.

Non-structural measures could consist of evacuation of the 25-year floodplain (buyouts), flood warning systems, changes in gate operations at existing reservoirs, floodproofing, and/or zoning.

Structural Alternatives

Levees would be earthen structures constructed to various lengths and widths dependent upon the location and application. Construction of each levee would result in a levee ditch or sump area parallel to the levee for interior drainage and sump pumps or flood gates. Levees would be constructed for the purpose of keeping floodwaters from entering the area to be protected. Levees, from a benefit-to-cost ratio perspective, would only be used in urban or developed areas to protect residential and commercial development and would not generally be used to protect agricultural lands alone.

Floodwalls serve the same function as levees and are used in situations where there is limited space. The floodwalls may be constructed to heights similar to levees. The floodwalls are concrete walls constructed between the stream and the areas to be protected. Floodwalls also have sump areas and sump pumps or floodgates. Similar to levees, from a benefit-to-cost ratio perspective, floodwalls would only be used in urban or developed areas to protect residential and commercial development and would not generally be used to protect agricultural lands alone.

Relief channels are channels that would be excavated across a bend in a stream for the purpose of moving floodwaters downstream faster and reducing flood event water surface elevations in the vicinity of the relief channel. The channel bottom elevation would be set high enough to divert floodwaters but not capture the normal stream flow. These channels could be lined with either concrete or maintained herbaceous vegetation (e.g. grass).

Diversion channels are similar to relief channels but are constructed to move water from one stream channel to another such as from a point in a creek to the Colorado River bypassing the lower reaches of the creek. The channel bottom elevation would be set high enough to divert floodwaters but not capture normal stream flows.

Tunnels would function similar to relief channels in that they capture flood flows and reduce flood event water surface elevations while maintaining the normal flow path of the stream. Tunnels can also be used as diversion. Tunnels can be constructed by boring so as to not disturb the surface or by open-trench excavation.

Dry detention basins, as the name implies, are reservoirs that do not retain water for long periods and are generally dry. A dam with a fixed or variable volume discharge outlet would be constructed in a stream. Dry detention basins capture flood flows and then release the water at a controlled rate to reduce flood event water surface elevations downstream. Low flows are released by culverts and are not retained. Large scale dry detention basins would only be feasible upstream of the Highland Lakes or on tributaries.

Multipurpose reservoirs would be constructed to retain water at a given pool level for water supply but would have floodwater storage to hold floodwater to be released at a controlled flow rate. The multipurpose reservoirs would provide flood reduction benefits, water storage, recreation benefits, wildlife habitat, and water supply. Similar to dry detention basins, multipurpose reservoirs would only be feasible upstream of the Highland Lakes or on tributaries of the Colorado River.

Detention basins are similar to dry detention basins but on a smaller scale. These basins can be constructed either on a stream or adjacent to the stream. Detention basins can be constructed by

placing a berm or dam across the stream or by excavating a basin into the streambed. Detention basins can have a small pool of water that is retained or held and released at an even slower rate to improve water quality.

Channel improvements would consist of the widening, deepening and straightening of a stream or drainage to increase flood storage and conveyance. Material would be excavated from the stream or drainage and removed from the floodplain. Channels could be maintained with natural bottoms and vegetation, or could be lined with concrete or rip rap.

Highland Lakes: The structural measure for the Highland Lakes Interim Feasibility Study includes, but is not limited to a dry detention basin on the Llano River or on the Colorado River above Lake Buchanan or a combination plan.

Shoal Creek: The Shoal Creek Interim Feasibility Study has not been initiated, but the structural measures that have been considered in the past and would most likely be considered in the future include but are not limited to: detention basins, channel improvements, levees, tunnels, diversion channels, and combinations of these measures on Shoal Creek.

Walnut Creek: The Walnut Creek Interim Feasibility Study has not begun yet, but the structural measures that would be considered include but are not limited to detention basins, channel improvements, levees, and combinations of these plans on Walnut Creek.

Onion Creek: The structural measures for the Onion Creek Interim Feasibility Study include but are not limited to: detention basins, channel improvements, levees, flood walls, relief channels, and combinations of these on Onion Creek.

Wharton: The structural measures for the Wharton Interim Feasibility Study include but are not limited to: levees, floodwalls, diversion channels, channel improvements, and combinations of these on the Colorado River, Caney Creek and/or Boughman Slough.

Non-Structural Alternatives

Evacuation of the floodplain (buyouts) would involve the purchase of structures within the 25-year floodplain. The structures would be demolished or moved out of the floodplain to another location and the area revegetated using native vegetation.

A flood warning system would consist of a network of stream gauges with radio transmitters linked to a central computer that is set to notify the appropriate emergency personnel in the event of flooding. Notification could be in the form of warning sirens and/or phone calls to persons living in flood prone areas. Computers could be programmed with the telephone numbers of persons living in

the flood prone areas. These numbers could then be automatically dialed in the event of a flood.

Changes in gate operations at existing reservoirs would change the timing and duration of flood storage and releases to reduce flood damages within the pool of the reservoir or downstream.

Floodproofing would involve raising floodprone structures to elevations above the level of the 25-year floodplain. Buildings would be placed on pilings, piers, or raised foundations.

Zoning would involve recommendations from USACE to have the jurisdictional body of government (i.e. cities and counties) implement zoning requirements that include but are not limited to: no future construction in a set floodplain, limits on impervious cover, and no net increase of discharge off of individual properties.

Highland Lakes: Non structural measures for the Highland Lakes Interim Feasibility Study include but are not limited to: a change in gate operations of the Highland Lakes, the evacuation of the floodplain, flood-proofing, and combination plans.

Shoal Creek: The Shoal Creek Interim Feasibility Study has not been initiated, but the non-structural measures that have been considered in the past and would most likely be considered in the future include but are not limited to: floodproofing, zoning, the evacuation of the floodplain, and flood warning system measures on Shoal Creek.

Walnut Creek: The Walnut Creek Interim Feasibility Study has not been initiated, but the non-structural measures that have been considered in the past and would most likely be considered in the future include but are not limited to: floodproofing, zoning, evacuation of the floodplain, and a flood warning system for Walnut Creek.

Onion Creek: Non-structural measures for the Onion Creek Interim Feasibility Study include but are not limited to: the evacuation of the floodplains and a flood warning system.

Wharton: Non-structural measures for the Wharton Interim Feasibility Study include but are not limited to: the evacuation of the floodplain and floodproofing.

2.2.2 Ecosystem Restoration Alternatives

Ecosystem restoration projects can be a component of a larger project or be stand-alone projects and are designed to restore a degraded environment to a less degraded state. The ecosystem restoration alternatives generally fall into the following three types of actions, but there are unlimited measures and/or combinations of measures that can be utilized in order to perform ecosystem restoration projects.

- 1) Preservation would be the acquisition and preservation of existing ecosystems. This would include the acquisition of lands along the Colorado River or its tributaries with minimal restoration needed.
- 2) Removal of invasive or undesirable terrestrial or aquatic vegetation and restoration of native species. Removal of invasive plant species would be accomplished using mechanical harvesting devices or herbicides and then native plant species would be replanted.
- 3) Physical alteration of degraded or severely altered properties to restore preexisting ecosystems. This could include the removal of existing structures including levees or drainage structures, restoration of stream banks, earthmoving associated with removal or restoration of native vegetation, and reestablishment of in-stream riffle/pool sequences or constructing features like levees, rock revetments, or other features to restore a natural feature that been destroyed.

The Highland Lakes, Shoal Creek, Walnut Creek, and Wharton Interim Feasibility Studies currently have no ecosystem restoration alternatives identified; however, measures could be added at a later date.

Onion Creek: Ecosystem restoration measures that could be implemented as part of the Onion Creek Interim Feasibility Study on Onion and Williamson creeks include but are not limited to: restoring riffle/pool sequences, restoring stream banks, removal of invasive vegetation and restoration of native vegetation, removing structures and planting native vegetation, and restoring severely degraded habitats along the river in the floodplain such as old gravel pits.

Austin Area Lakes Section 206: Ecosystem restoration measures that could be implemented as part of the Austin Area Lakes Section 206 include but are not limited to: removal of invasive species, planting of submerged aquatic plants and planting of native riparian vegetation along the river and in the lake. It should be noted that LCRA currently has active invasive species removal programs on Lake LBJ and Lake Austin.

Mad Island Section 206: Ecosystem restoration measures that would be implemented as part of the Mad Island Section 206 include but are not limited to: constructing rock revetments to prevent salt water intrusion and marsh erosion along the GIWW.