U. S. Army Corps
of Engineers
Fort Worth District

PLANNING DESIGN REPORT
AND
INTEGRATED ENVIRONMENTAL ASSESSMENT

WALNUT BRANCH SECTION 206
ECOSYSTEM RESTORATION PROJECT

SEGUIN, GUADALUPE COUNTY, TEXAS

December, 2003

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1. INTRODUCTION*

Integrated EA and Planning Design Report

This combined document contains information relevant to both an environmental assessment to satisfy the National environmental policy act (NEPA) and Planning Design Report used as a planning document by the U. S. army Corps of Engineers (USACE). Those sections that evaluate the potential impacts that could result from implementation of the proposed project are designated with an (*). A Finding Of No Significant Impact (FONSI), if appropriate, will be issued after public review of the environmental assessment.

Study Area

Walnut Branch is located within the limits of the city of Seguin, Guadalupe County, Texas. This location resides in Texas congressional district 21, Lamar Smith presiding. The proposed restoration site is located along Walnut Branch from New Braunfels Street (FM 78) downstream to Austin St (Loop 123) near the confluence of the Guadalupe River (Fig. 1). An existing USACE flood damage reduction project that was completed in 1989, runs from New Braunfels Street to near Jones Avenue. The stretch of Walnut Branch from the lower end of the USACE project downstream to Court Street, approximately 0.6 river miles, has also incurred channel modifications for flood reduction purposes. The lower portion of the creek from Court Street to the confluence with the Guadalupe River flows through downtown Seguin and is a spring fed, deeply incised channel.

Purpose and Scope

The purpose of the recommended restoration project is to restore the riparian corridor, stream riffle-pool complexes, and vegetation within Walnut Branch to a less degraded, more natural condition. The restoration will benefit all resident and migratory wildlife along the stream corridor. Specific restoration activities include planting 27.6 acres of riparian forest; control of approximately 5.8 acres of non-native plant species and replacement with high quality native trees and undercover plants; installation of small low water structures; modification of historic dams to restore 550 linear feet of riffle-pool complexes; removal of some large concrete debris within the natural channel and bank stabilization of approximately 600 feet of bank using native stone. The project will also create 0.5 acre of off-channel emergent wetland to increase the amount of this valuable habitat present in Walnut Branch.

Riparian corridors not only function as filters to improve inputs to streams and a highly valuable habitat for resident wildlife, but have also been indicated as playing a major role in providing a “landmark” and resting sites for migratory wildlife. In particular, neotropical songbirds have experienced wholesale diminishment of populations due to reductions in breeding, migratory and/or over wintering habitat. Riparian vegetation provides shade to lower water temperature, structure for nesting, shelter and food including acorns, nuts and other seeds. Riparian woodlands also provide structure for a thriving insect base that in turn is a staple food item for countless birds and other wildlife.

Walnut Branch is a small stream with extensive urban encroachment and a history of channel modification. Under Section 206 of the Water Resources Development Act of 1996, as amended, the USACE and City of Seguin propose to alleviate factors contributing to the degradation of this ecosystem while restoring the riparian habitat along the stream.

Goals and Objectives

The goal of the recommended project is to improve the structure and function of the riparian corridor, stream riffle-pool complexes, and water quality within Walnut Branch to benefit all resident and migratory wildlife. Due to channelization for flood reduction, most of the upper reach of Walnut Branch lacks any riparian habitat of value to wildlife. Reforestation of these areas would improve the habitat value, function and continuity of the entire corridor. Restoration of wetlands lost when the flood channel was constructed would also provide valuable habitat for emergent and aquatic plants and associated wildlife.

The flood channel upstream and the development within the drainage have had a profound impact on the stream channel dynamics through the project area. Despite this, the riparian corridor along the lower reach is of relatively high quality with regards to wildlife habitat. Invasion of non-native plant species, in particular privet (*Ligustrum spp*.), threatens the composition and sustainability of this riparian community by out-competing native understory plants and preventing the regeneration of overstory hardwood trees. This situation has also contributed to erosion of the steep stream banks in this area and therefore added to the high silt load of the stream. Restoration of riparian community structure would improve the filtration of runoff and prevent erosion of soils in the area. An increase in diversity of riparian species would insure the sustainability of the riparian corridor and the functions it provides.

Increased volume and velocity of water within the channel due to development within the watershed and flood reduction activities upstream have lead to the failure of banks within the project area. Bank failures have contributed to the high silt load found in Walnut Branch. The stream also exhibits a riffle/pool ratio that is skewed towards having larger pools than would normally occur in a stream of this type. The overabundance of pools is due to the hydrologic controls provided by multiple historic dams and utility line crossings. Reduction in the number of pools through the project area would benefit the aquatic ecosystem. Further, bank stabilization in key areas as well as control of non-native species would restore the function of the riparian corridor.

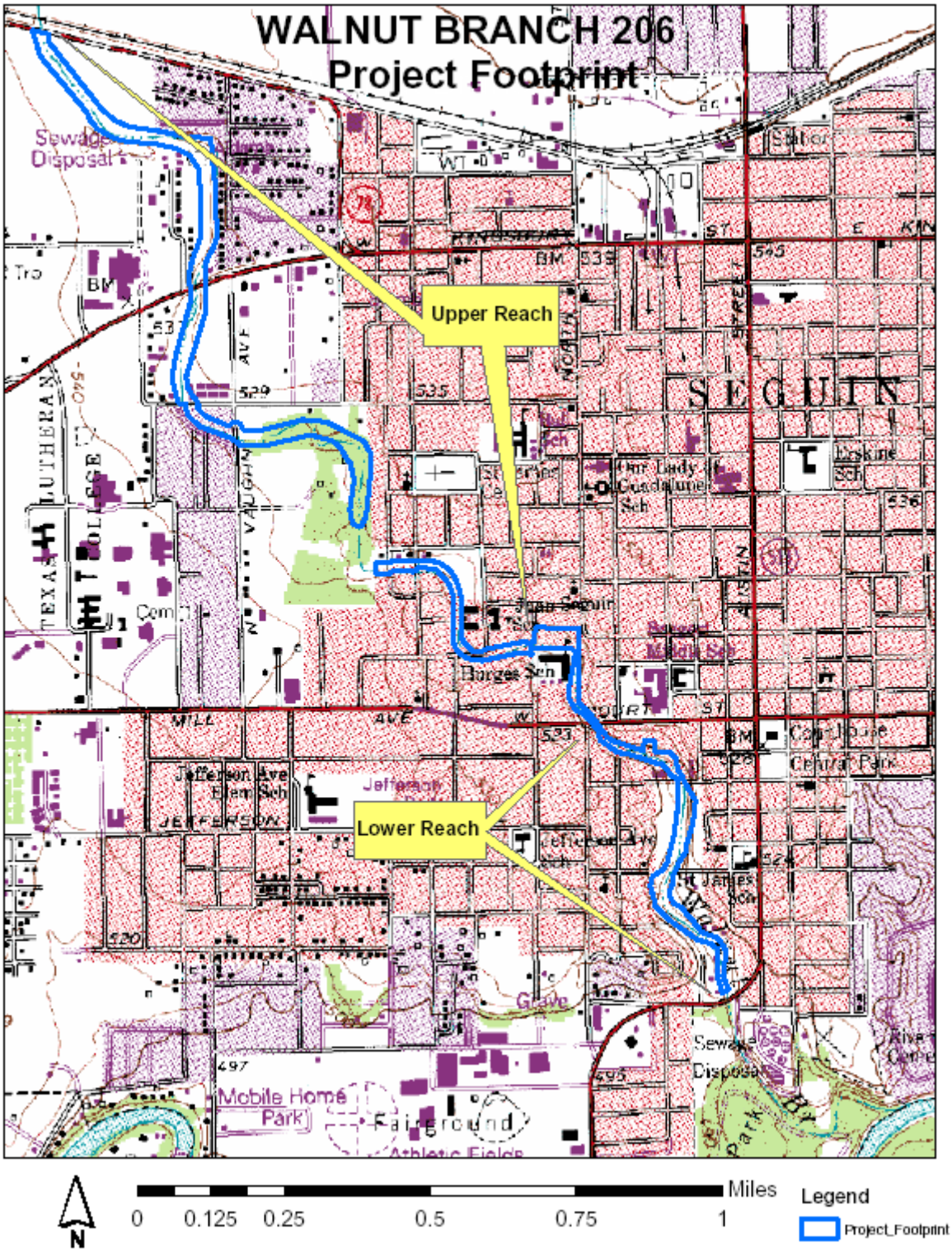

Figure 1. Project Location

Study Authority

With the City of Seguin as cost shared sponsor and under the authority of Section 206 of the Water Resources Development Act of 1996, Public Law 104-303, as amended, which authorizes the Secretary of the Army to carry out aquatic ecosystem restoration and protection. More specifically, this authority is used to restore degraded aquatic system structure, function and dynamic process to a less degraded, more natural condition, which will involve consideration of the ecosystems natural integrity, productivity, stability and biological diversity. The USACE has completed a feasibility study for this proposed restoration project.

Prior Studies and Reports

Several prior studies and reports have been produced on the flooding problems of Walnut Branch. The Texas Water Development Board published a report entitled "A Hydrologic Study of the Flood of September 26-27, 1973, for Several Watershed Areas in and Around the City of Seguin, Texas", 1974. This report detailed the magnitude and extent of the flooding in 1973.

The Corps of Engineers prepared a Reconnaissance Report in 1975 on the flooding problems in Seguin under authority of Section 205 of the Flood Control Act of 1948, as amended. It was concluded that enough damageable property existed in the flood plain to warrant more detailed studies to determine if there was sufficient Federal interest for construction of a local flood damage reduction project.

In December of 1975 under the authority of Section 205 of WRDA, the Corps of Engineers published a report entitled "Special Flood Hazard Information, Walnut Branch, Seguin, Texas." This report defines the flood risk involved in the development of the area studied.

In June 1979 the Corps of Engineers prepared a "Detailed Project Report (DPR) for Flood Control, Walnut Branch, Seguin, Texas." The local interests indicated they could not provide the necessary requirements to complete the flood reduction project. At the request of Congressman Abraham Kazen of the House Committee on Public Works and Transportation passed a resolution directing the USACE to conduct further studies under its General Investigations Program

In February 1977, Espey, Huston, and Associates, Inc. prepared a report for the city of Seguin entitled "Preliminary Flood Plain Management Plan, Walnut Branch, Seguin, Texas." This report deals with flooding problems and provided a preliminary assessment of alternative solutions.

In August 1983 a feasibility report was finalized under the General Investigation authority. The selected plan recommended a grass-lined channel with 10-year level of protection from Vaughn Avenue to New Braunfels Street. Construction of this plan was carried out and the flood reduction project was completed in 1990.

2. EXISTING CONDITIONS AND ENVIRONMENTAL DEGRADATION*

Location

Walnut Branch is located within the level to gently rolling terrain of the blackland prairie region of south central Texas. The watershed drains 7.8 square miles of land. The upper 5.56 square miles of drainage area are mainly cultivated or open agricultural land. The watershed's remaining 1.72 square miles lie almost entirely within the limits of Seguin, Texas, and contain residential and commercial development with some tracts of open areas. Approximately 3,700 people reside within the six distinct drainage areas in the urbanized portion of the watershed.

Climate

The climate may be classed as subtropical with mild winters and warm summers. The mean annual temperature is 69 degrees Fahrenheit. The mean annual rainfall for the city of Seguin is 30.23 inches with recorded annual differentials of -15.23 and +19.24 inches. Flood producing storms may occur at any time but are predominantly spring and fall events.

Physiography and Geology

In the Walnut Branch flood plain the clay shale bedrock is overlain by approximately 25 to 35 feet of alluvial materials. These overburden materials generally consist of a +5-foot thick surface stratum of dark gray, organic clay, underlain by a +25-foot thick sandy unit with variable amounts of clay, silt, and gravel. Exploration borings within the project limits generally encountered free water in this sandy unit and is most likely the source of springs that feed the lower reaches of Walnut Branch.

Air Quality

The Environmental Protection Agency (EPA) uses six "criteria pollutants" as indicators of air quality, and has established for each of them a maximum concentration above which adverse effects on human health may occur. These threshold concentrations are called National Ambient Air Quality Standards (NAAQS). Areas of the country where air pollution levels persistently exceed the NAAQS may be designated as nonattainment areas. Conversely, areas of the country that do not persistently exceed the NAAQS are designated as attainment areas. The recommended project area would be located entirely within the Metropolitan San Antonio Intrastate Air Quality Control Region (AQCR) #217. AQCR #217 is currently designated as either in attainment or unclassifiable for all criteria pollutants.

Surface Water

Median annual flow in Walnut Branch is less than 5 cubic feet per second (cfs). The portion of Walnut Branch from its origin to Taylor Street (about 1.3 river miles above the confluence) does not exhibit constant flow. During the summer much of the streambed in this section is dry.

Ground Water

Walnut Branch sits over the Carizo-Wilcox aquifer. As mentioned in the Physiography and Geology section a 25-foot layer of sandy and gravely soil exists below a five foot

layer of clay. The former layer tends to hold water and is the source of the spring flow into Walnut Branch.

Terrestrial and Aquatic Resources

There is regular flow in Walnut Branch streambed from approximately Saunders Street to the confluence with the Guadalupe. This water is of good quality. Flow in the Branch originates as seepage within the streambed near Saunders Street and picks up considerable volume from contributing springs from here to the confluence with the Guadalupe. Total flow in the stream from Court Street to the South Austin Street overpass under normal conditions is approximately 0.5 to 1 cfs.

The study area is located in the Texan biotic province. The region's vegetation strongly reflects the nature of its soils, which provide little moisture surplus for plant growth. The original vegetation consisted of alternating tall grass prairies and wooded savannahs, but has been complicated by increases in native woody species, invasion of drought tolerant species from the south and west, and extensive urbanization.

The upper reach of Walnut Branch from New Braunfels Street to Court Street is ephemeral and characterized by the grass-lined, trapezoidal flood channel with some concrete bend armoring. The dominant vegetation in the upper study reach is Johnson grass. Prior to construction of the Walnut Branch Flood Control Project, the floodway along Walnut Branch was comprised of a meandering stream with high quality riparian forest. What few hardwood trees remain are scattered and disjunct. One relatively large area of forested habitat remains, however this area is comprised mainly of young cedar elm, hackberry and chinaberry trees with a dense mid-story of non-native privet (*Ligustrum spp*.). The last 1/10 of a mile of the upper reach receives some permanent water from a spring and groundwater seepage. This area remains wet year-round and supports a small stretch of emergent wetland before transitioning into stream habitat.

The lower reach of Walnut Branch is fed by springs and maintains a more natural, although deeply incised channel configuration. Riparian habitat within the narrow corridor (usually less than 100 ft from the center of the stream) is of good value although lacking in diversity of species. An over-story of live oaks dominates the riparian woodland with a mix of cedar elm and non-native chinaberry trees. A very dense mid-story of privet exists with sparse or no groundcover. Pecan trees that once occurred along Walnut Branch were harvested in early 1900 and are now only found in a few park-like parcels along the stream. The low diversity lessens the productivity of the riparian system and makes it more vulnerable to species-specific diseases such as Oak Blight. Further, the absence of hardwood trees with less than 12-inch diameter trunks suggests that no new recruitment of these trees is occurring. The dense mid-story of privet appears to be impairing the reproduction of the native tree species that would replace the existing old growth native oaks, and elms. The privet is also preventing the establishment of low growing plant species through competition for sunlight and other resources. Without active management, this area will not likely sustain the present habitat quality.

The aquatic habitat of Walnut Branch is of moderate quality with an altered riffle/pool ratio and high embeddedness. Areas within the lower reach are subject to scouring erosion and bank failures. Five small dams that were built in the early 1930's remain in the channel of Walnut Branch. These dams and an abandoned sewer line create larger and deeper pools than would normally exist in a stream this size. The relatively high level of embeddedness (pools = 70% and riffles = 50%) is an indication of a high load of silt for a stream this size. This silt load is likely the result of streambank erosion as the channel adjusts to the increased volume and velocity of run off from additional impermeable surfaces within the watershed as development continues, as well as from channelization of the upper stream reach. The lack of ground cover along the riparian corridor also contributes to the high silt load. Temperatures within the stream along the lower reach remain relatively cool due to the springflow and good canopy coverage. Loss of the large overstory trees, which will occurr due to the effects of urbanization and lack of regeneration, will undoubtedly result in increased water temperatures and therefore degradation of the aquatic habitat. The aquatic habitat value of the upper and lower study reaches would be considerably improved with the development of riffle habitat, bank stabilization, and restoration of the riparian forest corridor.

Birds

There are over 150 species of birds that have been recorded near Seguin and likely to occur in the study area. Riparian corridors, such as the one found in Walnut Branch, provide important resting and foraging areas for migratory birds and waterfowl and are used by migrating birds as landmarks. The following bird species were seen or heard during site visits and are a few species that would be expected to be abundant throughout most of the year: Common grackle, American robin, northern cardinal, belted kingfisher, Carolina chickadee, mourning dove, eastern meadowlark, eastern bluebird, tufted titmouse, yellow-rumped warbler, white-eyed vireo, eastern phoebe, downy woodpecker, yellowbellied sapsucker, common flicker coopers hawk, barred owl, and mockingbird.

Reptiles and Amphibians

Many species of herptiles are likely to occur in the study area including lizards, snakes, turtles, salamanders and frogs and toads. Five species of herptiles were observed during site visits: tadpoles most likely from the woodhouse toad, cricket frog, red eared slider, common snapping turtle and diamond backed water snake. Sliders are quite abundant in the deep backwater from the Guadalupe River at its confluence with Walnut Branch.

Fish

The major groups of fish that occur in Walnut Branch include the cyprinid fishes (minnows), members of the centrarchid fishes (sunfishes) and ictalurids (catfishes) in the larger and deeper pools. In the shallow riffle areas members of the percid fishes (darters) would be likely to occur. During surveys conducted using a backpack electro-fisher and casual visual surveys during site visits the following species were detected: largemouth bass, green sunfish, red ear sunfish, Rio Grande cichlid, Mexican tetra, yellow bullhead, moquitofish, and two species of shiner.

Protected Species

Based on coordination with the U. S. Fish and Wildlife Service (USFWS) and Texas Parks and Wildlife Department (TPWD) two federally listed species are found in Guadalupe County. The proposed threatened Mountain plover (*Charadrius montanus*) and the candidate species Cagle's map turtle (*Graptemys caglei*) could occur within the project area. Communications with USFWS determined that any proposed management activities are not expected to have any impact to the Mountain plover, and therefore, this species will not be discussed further.

Cagle's Map Turtle

The Cagles Map Turtle (*Graptemys caglei)* is a recently described species of map turtle that is confined to riverine habitat in the Guadalupe-San Antonio River System of Texas (Haynes and McKown, 1974). The Cagle's map turtle is currently found only in segments of the Guadalupe and San Marcos Rivers in Kerr, Kendall, Comal, Guadalupe, Gonzales, DeWitt, Hays, and Victoria counties (Dixon, 1987; Killebrew, 1992; Killebrew and Porter, 1991; Porter, 1992). Surveys using time-constrained basking turtle frequency indices and mark-recapture studies indicate that *Graptemys caglei* is distributed in three river segments: (a) The upper Guadalupe River, (b) the middle Guadalupe River, and (c) the lower Guadalupe River (Figure 1). The total estimated population of *Graptemys caglei* in the Guadalupe River is 11,717 (Babitzke, 1992).

Graptemys caglei is highly aquatic, and optimal habitat appears to include both riffles and pools (Haynes and McKown, 1974; Killebrew, 1991a; Killebrew, 1992; Babitzke, 1992). Gravel bar riffles and transition areas between riffles and pools are areas of high aquatic insect prey species productivity and are considered important for *Graptemys caglei* foraging. (Killebrew, 1991a; Killebrew, 1991b). Recent radiotelemetry studies indicate that males may spend most of their time in these areas (Craig, 1992).

Walnut Branch probably contains suitable habitat for the Cagle's map turtle, at least in the lower stream sections. The Service recommends considerations for this species with any alteration of the instream habitat.

Critical Habitat

No critical habitat has been identified for the above threatened and candidate species.

Cultural Resources

In March 1977, the Center for Archaeological Research of the University of Texas at San Antonio, conducted an archaeological and historical survey of Walnut Branch at Seguin, Texas. The historical survey concluded that the Sebastopol House, which sits on property adjacent to the creek is of historical significance. This property is currently designated as a state historic park and is adjacent to the stream channel where it was modified for flood control.

The above archaeological survey indicates there is no prehistoric evidence that requires special attention. It was, however, suggested that when any ground disturbing activities take place on Walnut Branch, a field archaeologist should inspect these sites.

According to local reports, a park which included rock masonry walls, trails, pools formed by rock dams and other such features was created in the early 1930's along the lower section of Walnut Branch. All the features are within the steep banks of lower Walnut Branch and subject to high flows during floods. Many of these stone features exist today in varying degrees of dilapidation. Some features have been damaged due to the stream bank failures. Dams within the stream were altered or dynamited in the 1950's due to a fear of mosquitoes and disease transmission. Some of these dams still function today and greatly influence the ecological functioning of Walnut Branch. Any movement or modification of these masonry structures would be coordinated with the Texas State Historic Preservation Office prior to implementation of any project.

Hazardous Material

A review of standard environmental record sources in accordance with ASTM practice E 1527 was conducted by USACE as part of a Hazardous, Toxic and Radiologic Waste (HTRW) investigation for the Walnut Branch study area. The database search identified facilities handling or generating HTRW within a one-mile radius of the study area. Recognized environmental concerns identified include; one large quantity hazardous materials generator and two small quantity generators, 18 leaking underground storage tanks (LUST), 35 underground storage tanks (UST), and three sites as Hazardous materials handlers. Of the 18 LUSTs the status of 16 of these sites is “Final Concurrence Issued, Case Closed”. One more site is pending final concurrence. The remaining site, located along North Austin Street (0.75 miles from Walnut Branch), has impacted groundwater and is undergoing monitoring. Four USTs and one other HTRW handler are located along Court Street within 500 feet of Walnut Brach.

It is unlikely that any of the recognized environmental conditions would pose an HTRW threat to the project area since very little excavation is expected to take place as part of any of the alternatives. Further, during site visits no evidence of HTRW concerns were detected by smell, soil stains or residue on the water of the stream.

Executive Order 12898, Environmental Justice

In February 1994, President Clinton signed Executive Order (EO) 12898 titled, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. The population of Seguin is approximately 22 thousand people, which is 25 percent of the population of Guadalupe County (US Census Bureau 2000). The population of Guadalupe county grew by 24150 people, or 37 percent, between 1990 and 2000.

The racial mix of Seguin consists predominantly of Caucasians (65%) and people claiming to be of some race other than Caucasian, African-American, Native American, Asian, Native Hawaiian, and other Pacific Islander (31%). The remaining four percent is divided among people claiming some other race, or two or more races (U.S. Census Bureau 2000). About 53 % of the total population of Seguin claim to be of Hispanic origin (U.S. Census Bureau 2000).

Employment, Poverty Levels, and Income

The total number of jobs in the study area in 2000 was 8.991. The manufacturing industry provided the most jobs, followed by the educational, health and social services, and retail trade industry. The 2000 annual average unemployment rate for Seguin was 5.5%. The median household income for Seguin was $31,618 in 2000. The estimated number of people of all ages in poverty for Seguin was 3,503.

Aesthetics

Aesthetic resources consist of the natural and man-made landscape features that appear natural to the area and give a particular environment's visual characteristics. The current visual characteristics of the upper reach of the project area are mostly open areas of mowed grass in close proximity to residential yards and houses. The Lower reach of Walnut Branch has the appearance of a lush forested stream corridor with dense vegetation and running water. One area along this reach had been designated the Rose Garden park which showcases many of the historic masonry walls and manicured grass under large pecan trees. Since the project area lies within the residential and downtown areas of Seguin, its aesthetic value lies in its natural landscape as a greenway and associated wildlife viewing opportunities.

3. ENVIRONMENTAL RESTORATION MEASURES*

An interdisciplinary project delivery team (PDT) made up of representatives from the community, USFWS, City of Seguin and USACE evaluated an array of possible structural and non-structural measures that could be implemented in restoring the ecology of Walnut Branch. Those measures are described in general terms below.

1. Reforestation: Clearing of lands for agriculture, urban development and construction of flood channels has left large areas of open landscapes where riparian woodlands once occurred. Areas include; flood channels in the upper reach, agricultural lands near the upper-most extent of the study and several small parcels throughout the study were identified as possible places for reforestation. These areas could be planted with trees and shrub species indicative of riparian woodlands in central Texas.

2. In-Channel Wetland Creation: The ephemeral nature of the upper channel of Walnut Branch prevents the establishment of wetland plants and systems within the channel. The PDT theorized that water could be introduced to the channel to form a small stream, thereby extending the wetland ecosystem and associated benefits into the upper reach. Sources of water included recirculating water by way of mechanical pump from the lower reach or use of wastewater from any of three local sources. Those sources included a wastewater treatment plant, a chicken processing plant and a power plant.

3. Off-Channel Wetland Creation: The PDT identified two parcels of land that could be used to create seasonal or emergent wetlands. Wetlands outside the stream channel would be removed from velocities of high flows while providing

high quality habitats for wildlife. These areas would also perform natural filtering of the stream and provide some degree of floodwater retention.

4. Riparian Woodland Restoration: As described in the Terrestrial and Aquatic Resources section, the riparian woodland in the lower reach is being impacted by non-native plant species and lacks the diversity found in similar pristine habitats. Restoration of the existing riparian woodland would require two steps. First, removal of the non-native privet and chinaberry then planting of ground cover plants and selected hardwood trees. Plantings of walnut, pecan, cypress and cottonwood trees would provide a diversity of overstory trees to improve the sustainability and productivity of this area.

5. Riffle/Pool Modification: In order to return the streams riffle and pool elements to a more natural balance, riffles would need to be created or pools diminished. Modification or removal of historic dams and low water structures would decrease the extent of pools and allow riffles to form. The installation of hard structures that create riffles would be limited due to the lack of stream reaches not covered by pools habitat.

6. Bank Stabilization: The PDT identified three types of problems that could be remedied by several bank stabilization methods. In several areas, banks have failed resulting in large amounts of riparian and streambank habitat toppling into the stream. Other areas were subject to bank scour due to high water velocities. One bank near the downstream end of the study is the site of small fences that are being used to retain fill dirt and are in various states or disrepair. Various methods or streambank stabilization were investigated to remedy these problems. Methods include, vegetative stabilization, re-sloping of banks to a shallower grade, and use of concrete or stone to retain banks and prevent erosion. Vegetative methods were ruled out due to the lack of sunlight afforded by the existing dense canopy and velocities present during high flow events. Other stabilization methods could be used and would need to be evaluated on a site by site basis.

7. A number of channel obstructions and utility lines were identified as causing or contributing to erosion, pool formation, and preventing sediment transfer through the stream. Removal of concrete debris could reduce erosion, and restore natural flow and channel bed transfer in Walnut Branch. Strategic placement of large boulders and tree trunks that are currently obstructing the channel could also reduce erosion while still providing aquatic habitat for fish and invertebrates.

4. ALTERNATIVES CONSIDERED*

Two alternatives for aquatic ecosystem restoration were developed in addition to the no action alternative. One alternative, which involved providing permanent water to the upper reach (measure no. 2), was rejected early in development due to physical and financial constraints imposed by the project. Numerous combinations of the remaining

measures were evaluated to develop the third alternative. This process is described in more detail below.

Alternative 1 - No action plan: The no action plan would most likely result in the persistence of the grass lined flood channel in the upper reach of Walnut Branch. There would not likely be any reforestation by desirable hardwood species in this area, and could possibly be colonization by invasive and non-native plant species. No off-channel wetland would be constructed. The lower stream reach would face continued dominance of the mid story by privet, preventing the regeneration of riparian trees and ground cover plants. Hardwood trees lost to attrition or disease would most likely be replaced by less desirable invasive tree species or not all. Erosion of soil within the riparian zone would continue due to the lack of ground cover contributing to the high silt load in the stream. Without stabilization, failed banks would continue to erode also contributing to the silt load. Riffle/pool ratios would remain skewed towards a high pool component. Finally concrete debris currently affecting the stream flow and channel dynamics would remain unless local entities removed them. The no action alternative would not achieve any of the restoration goals and most likely not result in any improvement of habitat in and along Walnut Branch.

Alternative 2 - Introduction of permanent water and improvement of the riparian forest: This alternative entails restoration of the riparian zone in the lower reach, as well as, bank stabilization and introduction of permanent streamflow through the upper reach. Water sources to be used in the upper reach would possibly include recycled water from industrial entities nearby or recirculating water from the lower reach using mechanical pumps. Measures considered involved the introduction of water to the upper reach were beyond the financial scope of the project due to the decontamination effort needed to prior to releasing the water into the stream. Further, local residents expressed concerns about an increase in mosquito populations. This alternative was not explored further.

Alternative 3 - Improvement of the riparian forest and aquatic habitat: This alternative consists of restoring a high quality riparian forest corridor along both the upper and lower reaches of the study area, removal of debris within the channel, modification of pool and riffle complexes, stabilization of eroded and fallen banks and creation of an off-channel emergent wetland in the upper reach. Measures were individually “optimized” and were combined to allow the maximum practical restoration. This alternative is considered to be the recommended action.

5. COST EFFECTIVENESS

Of the five general restoration measures only reforestation, and bank stabilization lent themselves to analysis of cost effectiveness. Wetland creation, privet control and riffle pool manipulation were deemed as all-or-nothing measures. That is, those measures that would have to be implemented to the fullest extent to produce the intended affect. Analysis of cost effectiveness of reforestation and bank stabilization will be presented in this section.

Reforestation

The planting of native trees and shrubs would occur along the flood channel in the upper reach of Walnut Branch (25 acres) and in select locations in the lower reach where habitat value were determined to be poor (2.6 acres). Generally, seedling trees will provide the healthiest and most well adapted tree when planting. Larger trees, however, will take less time to mature and therefore realize their intended benefits earlier. Combinations of different sized trees were analyzed incrementally to find the combination which provides the best cost/benefit ratio. Three size classes of trees that are regularly available were used; seedlings, 1-inch caliper and 4-inch caliper. The combinations presented in Table 1. consist of 704 trees in different proportions of each size class with the exception of the increment with all seedlings. One thousand tees would be used in this increment to offset the high mortality incurred when planting seedlings. Table 1. shows that a combination of 10 % 4 inch caliper, 20% 1inch caliper and 70% seedling trees provides the highest habitat output to cost.

Table 1. Riparian Forest Restoration		4" / 1" / Seedling = 100% of 704 trees*		
	0/0/100	10/20/70	20/30/50	40/60/0
FIRST COST	**$100,000**	**$105,400**	**$133,500**	**$197,200**
ANNUAL INTEREST RATE (decimal)	**0.05875**	**0.05875**	**0.05875**	**0.05875**
PROJECT LIFE (years)	**50**	**50**	**50**	**50**
CONSTRUCTION PERIOD (months)	**36**	**36**	**36**	**36**
INTEREST DURING CONSTRUCTION	$8,987	$9,473	$11,998	$17,723
INVESTMENT COST	$108,987	$114,873	$145,498	$214,923
INTEREST	$6,403	$6,749	$8,548	$12,627
AMORTIZATION	$391	$412	$522	$772
OPERATIONS & MAINTENANCE	**$1,500**	**$1,000**	**$1,000**	**$1,000**
REPLACEMENTS	**$0**	**$0**	**$0**	**$0**
TOTAL ANNUAL CHARGES	$8,294	$8,161	$10,070	$14,398
With Project Habitat Units	837.20	898.80	984.40	1005.10
No Action Habitat Units	230.00	230.00	230.00	230.00
With Project TOTAL AAHU	16.74	17.98	19.69	20.10
No Action TOTAL AAHU	4.60	4.60	4.60	4.60
AAHU GAIN	**12.14**	**13.38**	**15.09**	**15.50**
ANNUAL COST/AAHU GAIN	$682.99	$609.95	$984.40	$928.92

Bank Stabilization

Three methods of bank stabilization were analyzed for cost effectiveness in three combinations or increments. The three methods include stabilization with stacks of 2ft X 2 ft X 8ft cut limestone blocks, rip rap slopes and simple re-sloping of existing soil banks to a 3 on 1 ratio (layback). Each combination included installation of one riffle crib structure, and care of water. The two combinations which included 450 and 400 linear feet of layback banks would require the purchase of additional property a long the stream to accommodate the construction. Major constraints determining the method of stabilization include the presence of historical structures within close proximity of stream bank, and the narrow confines of the stream corridor. Whereas layback slopes and rip rap require a wider construction footprint that in many cases would destroy historic structures, valuable riparian habitat or require the additional purchase of real estate, a more vertical form of stabilization performed the required function. In the few places that either method could be used the higher material costs of the vertical solution, in this case stacked stone blocks, was offset by the ability to keep the construction footprint narrow.

Table 2. Stream Bank Stabilization		**STONE WALL/ RIP-RAP/ LAYBACK**	
Linear Feet of Stabilization Method	550/120/350	450/120/450	500/120/400
FIRST COST	**$597,698**	**$607,698**	**$627,698**
ANNUAL INTEREST RATE (decimal)	**0.05875**	**0.05875**	**0.05875**
PROJECT LIFE (years)	**50**	**50**	**50**
CONSTRUCTION PERIOD (months)	**36**	**36**	**36**
INTEREST DURING CONSTRUCTION	$53,717	$54,616	$56,413
INVESTMENT COST	$651,415	$662,314	$684,111
INTEREST	$38,271	$38,911	$40,192
AMORTIZATION	$2,339	$2,378	$2,456
OPERATIONS & MAINTENANCE	**$1,000**	**$1,000**	**$1,000**
REPLACEMENTS	**$0**	**$0**	**$0**
TOTAL ANNUAL CHARGES	$41,609	$42,289	$43,648
With Project Habitat Units	101805.00	101619.90	101619.90
No Action Habitat Units	52599.25	52599.25	52599.25
With Project TOTAL AAHU	2036.10	2032.40	2032.40
No Action TOTAL AAHU	1051.98	1051.98	1051.98
AAHU GAIN	**984.12**	**980.42**	**980.42**
ANNUAL COST/AAHU GAIN	$45.28	$43.13	$44.52

6. DESCRIPTION OF THE RECOMMENDED ACTION

As stated, the recommended project consists of restoring a high quality riparian forest corridor, removal of debris within the channel, modification of pool and riffle complexes, stabilization of eroded and fallen banks and creation of an off-channel emergent wetland.

Major Features of the Project: The measures that could be implemented in the recommended restoration include:

1. Restoration measures were evaluated for the upper and lower reaches. To minimize real estate acquisition and maximize restoration opportunities within the fiscal limitations of the project, only those areas in the upper reach that are already owned by the city were included for proposed reforestation. A total of 25 acres on top of the flood channel banks was identified for planting native tree and shrub species. Three small areas totaling 2.6 acres exist within the lower reach of the project area and are of low quality habitat compared to the surrounding riparian forest. These areas consist of mowed Bermuda grass communities with few, widely spaced trees. These areas will also be planted with native tree and shrub species.

   Five combinations of differing proportions of 2-4 inch caliper, 1 inch caliper, seedling trees were evaluated to determine which combination would produce the highest habitat outputs per cost ratio. Analysis revealed that a mixture of 10% 4-inch caliper, 20% 1-inch caliper and 70% seedling trees would produce the highest number of habitat outputs per cost of implementation of the plantings (Table 1.). Habitat benefits such as food production, nest sites and cover are realized sooner from planting some larger trees. These resulting higher habitat outputs would offset the higher cost of the larger trees. A total of 704 trees would be planted in irregular spacing outside the flood channel and in open spaces through the lower reach. Species to be planted would include; live oak, native pecan, walnut, mulberry, soapberry and persimmon.

2. One area was found to be feasible for construction of an off-channel wetland. Additional opportunities were constrained by acquisition costs and proximity to water. A 0.5 acre wetland would be created adjacent to the flood channel near Saunders Street using water from an adjacent spring. The narrow, linear wetland would provide habitat for emergent wetland plants as well as wildlife that use this habitat. Current plans to improve Guadalupe Street would include renovations to the stormwater drains and culverts. If feasible, these renovations would terminate the main stormwater culvert at the proposed wetland. In this way the wetland would accommodate detention of stormwater and act as a filter for non-point pollution washing into the creek from the city street.

3. In the lower reach, 5.8 acres of existing riparian woodland has been invaded by non-native privet and tree species. Restoration measures in this area would include clearing of non-native shrub species and planting of high quality native trees and groundcover plants. Control of the non-native privet and chinaberry

trees along with limited thinning of hackberry trees along the lower portion of the stream would increase the amount of sunlight reaching the forest floor and allow native trees and ground cover plants to regenerate. To suspend erosion and provide immediate wildlife benefits to the area, groundcover plants would be planted following privet control. In areas of canopy gaps, walnut, pecan and cottonwood trees would be planted using a combination of 2-4 inch caliper, 1-inch caliper and seedling trees. These plantings would provide a diversity of overstory trees to improve the sustainability and productivity of this area

4. Modification of two historic dams, removal of one abandoned sewer line and installation of two small, low water structures to would convert up to 150 linear feet of pool habitat to riffle habitat. Drilling of up to five, four-inch holes through the masonry dam at Austin Street 18 inches below the overflow slots would lower the pool being held by this dam and restore up to two riffle reaches upstream. Cutting a notch 12 inches deep into remnants of an historic dam near West Shelby Street would restore one riffle reach approximately 200 feet upstream of this dam. Installation of one riffle crib structure would be required to maintain hydraulic control of a split in the channel at the historic dam mentioned above. The riffle crib structure would consist of a concrete foundation below channel grade with natural stone boulders anchored to the foundation with stainless steel pegs (Figure 2). Graded stone riprap would be placed around the anchored boulders.

5. Removal of some large concrete and stone debris within the stream channel would restore natural flow and channel bed transfer in two areas of the Walnut Branch. One abandoned sewer line crosses the stream channel between the two historic dams to be modified. This concrete encased line acts as a dam in this area and would be removed to restore the natural flow to this area. Two large boulders approximately 150 feet downstream of Court Street would be removed to improve stream-flow and alleviate erosion on the banks in this area.

6. Various methods of bank stabilization would be used to alleviate riparian degradation and inputs of silt into the stream. Three methods of bank stabilization were analyzed for cost effectiveness in three combinations or increments. The three methods include stabilization with stacks of 2ft X 2 ft X 8ft cut limestone blocks, rip rap slopes and simple re-sloping of existing soil banks to a 3 ft on 1 ft ratio (layback). Two combinations which included layback banks would require the purchase of additional property along the stream to accommodate the construction. Major constraints determining the method of stabilization include the presence of historical structures within close proximity of stream bank, and the narrow confines of the stream corridor. Layback slopes and rip rap require a wider construction footprint that in many cases would destroy historic structures, valuable riparian habitat or require the additional purchase of real estate. In the few places that either method could be used the higher material costs of the vertical solution, stacked stone blocks, was offset by the ability to keep the construction footprint narrow.

In four general areas, large amounts of riparian and streambank habitat have eroded and toppled into the stream. Repair and stabilization of these areas of bank failure using cut limestone blocks would restore the bank, decrease the amount of sediment entering the stream and provide interstitial spaces for invertebrate species. Stone walls placed in banks of pool reaches would include a submerged, horizontal stone slab protruding 12 inches from the side of the wall to simulate an undercut bank (fig 2.). In one small section of streambank exhibiting some evidence of scour, re-grading of the low bank and placement of stone riprap would stabilize this area. In the lower portion of the project area a 350-foot long makeshift retaining wall consisting of wire fence, corrugated tin and wood, holds 2 to 4 vertical feet of rock and soil. During high flows this area is a probable source of silt inputs to the steam. This area would be re-graded to provide a stabile bank slope without the use of a retaining wall.

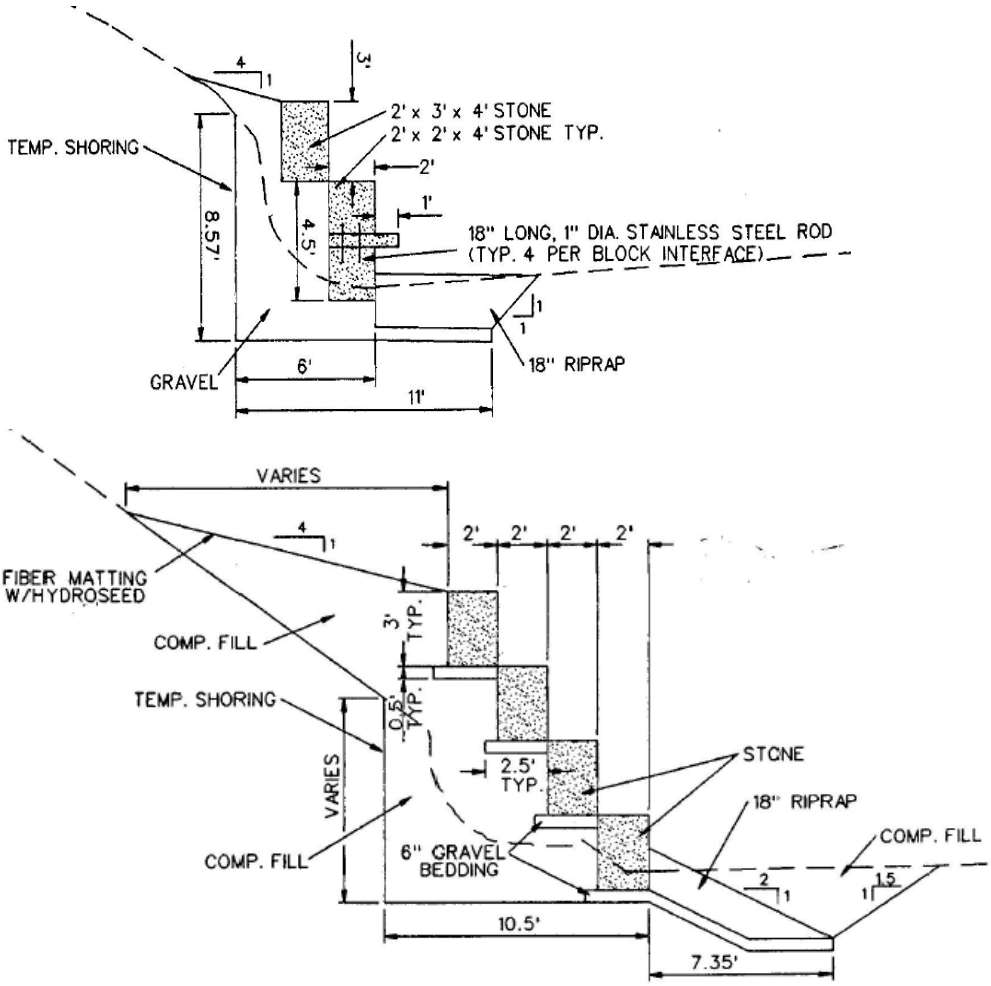

Figure 2. Typical cross sections of two types of cut stone bank stabilization

In total, up to 1020 linear feet of stream bank stabilization are proposed under the preferred alternative. Included is 550ft of stone block wall, 120ft of rip-rap and 350ft of layback slopes.

7. COSTS AND BENEFITS

Restoration Outputs: Within the Seguin Walnut Branch area, riparian habitat is becoming increasingly scarce as urban development continues. The recommended restoration project would restore ecosystem structure and function to Walnut Branch, improve the stability and sustainability of riparian habitat, increase biodiversity and carrying capacity for resident and migratory wildlife, and complement the existing natural resources of the region. Principal beneficiaries would be resident and migratory waterfowl, neotropical songbirds, fish and other wildlife. The project would reforest or improve 33 acres of riparian forest and 0.6 miles of natural stream channel while creating an additional 0.5 acres of emergent wetland.

The North American Waterfowl Management Plan (NAWMP) has identified the degradation and loss of wetlands as a major factor that lead to the declining waterfowl populations. Partners in Flight (PIF) supported by Department of Defense has a goal to focus resource improving programs on the protection of neotropical bird species, those that breed in North America and winter in Central America. The recommended restoration project would benefit the goals outlined by both the NAWMP and PIF.

Benefits

An initial evaluation of existing habitat value, or quality, was derived using both Habitat Evaluation Procedures (HEP) developed by the U.S. Fish and Wildlife Service for terrestrial habitats and Habitat Suitability Indices (HSI) or in-stream habitats. These values are a rating of various habitat parameters with a resulting score from 0 to 1 with 0 having no value and 1 having the highest value possible. The HEP score is then multiplied by the appropriate unit of measure or habitat unit (HU). In the case of riparian restoration, acres is used as the HU while linear feet (LF) of stream reach was used for in-stream restoration HU's. Restoration outputs displayed in HU's were derived from extrapolation of current conditions and those conditions expected as a result of project implementation. Due to overlapping footprints and outputs, debris removal, bank stabilization and riffle/pool modification was combined into in-stream restoration. Note that restoration outputs may extend beyond the footprint of implemented measures as benefits are realized near or downstream of implementation sites.

Table 3. Restoration outputs calculated on an annualized basis. Net habitat outputs expressed in Habitat Units (HU) are presented by restoration measure in the summary tables below.

Walnut Branch, Seguin, Aquatic Ecosystem Restoration Project (Section 206)									
	Reforestation Upper								
No Action	Year	Base	1yr	5yr	10yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0	1	4	5	15	25		
	HSI	0.2	0.2	0.20	0.20	0.20	0.2		
	ACRES	25	25	25	25	25	25		
	HU at TY	5	5	5	5	5	5		
	Interval HU's	0	5	20	25	75	125	250	5

With Project	Year	Base	1yr	5yr	10yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0	1	4	5	15	25		
	HSI	0.3	0.4	0.60	0.80	0.90	0.9		
	ACRES	25	25	25	25	25	25		
	HU at TY	7.5	10	15	20	22.5	22.5		
	Interval HU's	0	10	60	100	337.5	562.5	1070	21.4
	Reforestation Lower								
No Action	Year	Base	1yr	5yr	10yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0	1	4	5	15	25		
	HSI	0.28	0.28	0.28	0.28	0.28	0.28		
	ACRES	2.5	2.5	2.5	2.5	2.5	2.5		
	HU at TY	0.7	0.7	0.7	0.7	0.7	0.7		
	Interval HU's	0	0.7	2.8	3.5	10.5	17.5	35	0.7
With Project	Year	Base	1yr	5yr	10yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0	1	4	5	15	25		
	HSI	0.3	0.4	0.60	0.80	0.90	0.9		
	ACRES	2.5	2.5	2.5	2.5	2.5	2.5		
	HU at TY	0.75	1	1.5	2	2.25	2.25		
	Interval HU's	0	1	6	10	33.75	56.25	107	2.14
	Wetland Creation								
No Action	Year	Base	1yr	5yr	10yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0	1	4	5	15	25		
	HSI	0.4	0.7	0.9	0.9	0.9	0.9		
	ACRES	0.05	0.05	0.05	0.05	0.05	0.05		
	HU at TY	0.02	0.035	0.045	0.045	0.045	0.045		
	Interval HU's	0	0.035	0.18	0.225	0.675	1.125	2.24	0.0448
With Project	Year	Base	1yr	5yr	10yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0	1	4	5	15	25		
	HSI	0	0	0	0	0	0		
	ACRES	0	0	0	0	0	0		
	HU at TY	0	0	0	0	0	0		
	Interval HU's	0	0	0	0	0	0	0	0
	Riparian Woodland Restoration								
No Action	Year	Base	1yr	5yr	10yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0	1	0	9	0	40		
	HSI	0.9	0.88	0.82	0.75	0.55	0.23		
	ACRES	6	6	6	6	6	6		
	HU at TY	5.4	5.28	4.92	4.5	3.3	1.38		

	Interval HU's	0	5.28	0	40.5	0	55.2	100.98	2.0196
With Project	Year	Base	1yr	5yr	10yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0	1	4	5	15	25		
	HSI	0.92	0.95	0.95	0.95	0.95	0.95		
	ACRES	6	6	6	6	6	6		
	HU at TY	5.52	5.7	5.7	5.7	5.7	5.7		
	Interval HU's	0	5.7	22.8	28.5	85.5	142.5	285	5.7
	Stream Restoration								
No Action	Year	Base	1yr	5yr	10yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0	1	4	5	15	25		
	HSI	0.46	0.46	0.46	0.4	0.35	0.3		
	Linear Feet	3085	3085	3085	3085	3085	3085		
	HU at TY	1419.1	1419.1	1419.1	1234	1079.75	925.5		
	Interval HU's	0	1419.1	5676.4	6170	16196.3	23137.5	52599.25	1051.985
With Project	Year	Base	1yr	5yr	10yr	25yr	50yr	Cumulative HU's	AAHU
	Year Interval	0	1	4	5	15	25		
	HSI	0.6	0.66	0.66	0.66	0.66	0.66		
	Linear Feet	3085	3085	3085	3085	3085	3085		
	HU at TY	1851	2036.1	2036.1	2036.1	2036.1	2036.1		
	Interval HU's	0	2036.1	8144.4	10180.5	30541.5	50902.5	101805	2036.1

MEASURE	WITH PROJECT	WITHOUT PROJECT	OUTPUT GAIN (HU = Acre)
Reforestation	1177	285	892
Wetland Creation	2.24	0	2.24
Riparian Restoration	285	100.98	184.02

MEASURE	WITH PROJECT	WITHOUT PROJECT	OUTPUT GAIN (HU = Linear ft)
In-stream Restoration	101805	52599.25	49205.75

The HEP evaluations were based upon the assumption that low value, unforested areas would remain so during the 50-year project analysis period and that current high value riparian forest in the lower reach of Walnut Branch would degrade over the analysis period under without project conditions. This is due to current maintenance practices within the flood channel in the upper reach and the fact that an overabundance of non-native privet in the mid-story of the forest in the lower reach is preventing the regeneration of the hardwood tree species and native groundcover plants. Designation of Walnut Branch as an ecosystem restoration area would bring about public knowledge of the importance of riparian systems. Continued operation and maintenance would assure

that project assumptions would be met in the future with project conditions. It is estimated that the recommended project would increase riparian forest habitat value by 379% above future without project conditions.

The stream bank stabilization and riffle-pool restoration values would also show dramatic results with the project in place. In-stream habitat values would increase by 193% over the without project conditions. The project would also create high value emergent wetlands in an area where none exists today.

Incidental benefits of the recommended project include improving water quality, reducing water turbidity, and the overall improvements in the general aesthetics of natural areas surrounding Walnut Branch.

Costs

The total cost for the recommended plan is estimated at $1,681,260. First costs for the various restoration measures, as well as, outputs are presented in Table 4. below. These cost estimates were developed based on preliminary designs of the proposed measures using similar efforts performed by USACE and other entities in recent projects. The average cost of $16.79/HU for terrestrial restoration and $12.15/HU for In-stream restoration is acceptable given costs for other projects in similar habitats.

Table 4. Cost per output from proposed restoration measures.

MEASURE	AREA AFFECTED	FIRST COST	OUTPUT (HU)	COST PER HU
Reforestation	27.6 Acre	$85,900	892	$96.3
Wetland Creation	0.5 Acre	$40,000	2.24	$17,857.14
Riparian Restoration	6 Acre	$26,700	184	$145.11
Totals	34.1	$152,600	1078.24	$18,098.55
Average cost per HU				$16.79

MEASURE	REACH AFFECTED	FIRST COST	OUTPUT (HU)	COST PER HU
In-stream Restoration	3085 LF	$597,698	49205.75	$12.15

Cost Apportionment

The recommended restoration project would be cost shared between the City of Seguin and the Federal Government. The City of Seguin will provide their contribution in lands, easements, rights-of -way, relocations and disposal areas (LERRD), and any remainder in cash. Reports and Plans and Specifications are initially Federally financed, and costs distributed as part of the non-federal share of the project costs during construction.

Table 5. Cost Apportionment Schedule

	Totals	Non-Federal	Federal	Fedal Funding Needs			
				FY+0	FY+1	FY+2	FY+3
Planning and Design Analysis	355,00	0	355,000	355,000			
Construction	1,326,260	588,441	730,500		430,500	200,000	100,000
Totals	1,681,260	588,441	1,092,819				

Based on a gross appraisal of the real estate required to implement the project, LERRD's costs are expected to slightly exceed 35% of the total project costs ($588,441). If in-fact the LERRDS value exceed the non-federal cost share, the City of Sequin has agreed to waive reimbursement by the federal government for those costs.

Operation and maintenance (O&M) consists of periodic re-treatment of privet, maintaining one riffle complex and rip rap, and any maintenance of bank stabilization structures. The City of Seguin will be responsible for operation and maintenance. Privet control will likely occur on a three-year cycle with an estimated cost of $1,200 each cycle for that measure alone. Monitoring and maintenance of bank stabilization structures were estimated at $7,500 over the life of the project. Average annual O&M costs are estimated at $550.

8. ENVIRONMENTAL EFFECTS*

Physiography and Geology

As proposed, bank stabilization would require some contouring of the existing stream bank in order to restore the bank. Following construction of bank protection measures, exposed areas that have been backfilled with topsoil would be seeded with native vegetation to secure soil and prevent erosion. During construction, Best Management Practices would be implemented to control erosion and siltation.

Land Use

The current land use within the Walnut Branch watershed is not expected change significantly. Land use at top of bank along the flood control channels, but within the existing right-of-way, may include a hike and bike trail as part of a separate project proposed for construction by the City of Seguin. The flood control channels would continue to be used for their intended purposes. The lower reach of Walnut Branch would continue to function as a stream corridor and may include a primitive nature trail as was constructed in the early 1930's. The purchase of lands or easements currently in private ownership along this reach would provide public access to the project so that this area can be maintained as a restoration project through the project life.

Surface Water

Construction-related activities associated with the recommended action may temporarily affect surface water quality due to sedimentation and siltation. Silt removal would be

accomplished where necessary. However, standard engineering and construction best management practices (BMPs) would be used to minimize erosion during construction. Construction associated with the recommended action would be in accordance with the provisions of Nationwide Permit 27, Stream and Wetland Restoration Activities, 7 June 2000. Consequently, State 401 Water Quality Certification would be blanket issued for the proposed action.

The recommended riparian restoration and bank protection would provide long-term beneficial impacts to water quality by eventually eliminating a large source of silt inputs to the stream. Modification of the riffle pool ratio within the stream would improve the natural function of the stream and restore it to a more natural state.

Ground Water

Ground water quality within the project area would not likely be adversely impacted.

Wetlands

The recommended project would not have any adverse effects on wetlands within the project area but would in fact create an additional 0.5 acres of wetland adjacent to the stream. The proposed restoration of riparian habitat would most likely benefit wetlands within the project area by increasing edge effects and diversity within the study area

Flood Plains

The recommended action would restore a section of Walnut Branch and its riparian habitat. The recommended action would be located within the 100-year floodplain or below top-of-bank in the lower reach. Consistent with Executive Order 11988, Floodplain Management, locating the recommended action in the floodplain would be the only practicable alternative. As such, modifications to the stream would be designed to minimize potential harm to or within the floodplain. In addition, the recommended project would not increase the base flood elevation to a level that would violate applicable floodplain regulations or ordinances

Flora

The recommended project would not have any adverse effects to flora in the area. Approximately 27.6 acres of Johnson grass and Bermuda grass communities would be altered by the planting of riparian tree species. In areas of tree planting ground cover plants would be expected to change to shade tolerant species as trees become mature. The recommended project would restore 33 acres of riparian woodland while improving the diversity of riparian woodlands that currently exist in Walnut Branch.

Removal of privet may have some adverse effects on existing native vegetation when the exotic shrub is physically removed. These effects would be temporary and the removal of privet would ultimately benefit all native plant species in the riparian corridor.

Fauna

Noise and other disturbances associated with construction would temporarily adversely impact terrestrial species utilizing wildlife habitats adjacent to the project site. Materials

used for the construction of the recommended project would provide some habitat for terrestrial animals. The utilization of stone riprap and stone blocks for this project would provide suitable habitat for small mammals, reptiles, and birds which utilize subterranean sites for shelter. Construction materials to be used for the recommended project would also provide habitat for prey items, which could be utilized by small terrestrial animals.

Aquatic organisms presently utilizing shoreline or near shore habitats adjacent to the project site would be displaced through any construction activity that requires bank removal or contouring. Fish, aquatic invertebrate, and other aquatic resources would benefit from the water quality improvements previously discussed. Reduction in Pool habitat will adversely affect those aquatic species that rely on this habitat however the resultant increase in riffle habitat is expected to benefit the overall stream community and provide additional areas for high benthic invertebrate production and therefore increase the forage base for other wildlife.

Following construction and throughout the proposed 50-year project life, fish and wildlife within the Walnut Branch corridor would benefit from project implementation. Riparian habitat would be restored in 27.6 acres of the upper reach where there is currently only Johnson grass and Bermuda grass. This would benefit resident and migratory wildlife that use riparian habitats for food, shelter and breeding sites.

Protected Species

The recommended action would not adversely impact any species Federally-listed or proposed for listing, or species designated by the TPWD as threatened, endangered, or rare. In addition, none of the aforementioned species' habitat would be adversely impacted.

Cultural Resources

The recommended action would not be expected to impact any cultural resources. Any cultural resources previously identified would be avoided during construction activities. If any cultural resources were found during construction, all construction activities would be halted until further examination by a qualified archeologist. The recommended action is not expected to have any significant negative impacts on historical resources.

Hazardous Material

If any HTRW was encountered or excavated, construction would cease and appropriate agencies would be notified.

Air Quality

Dust and exhaust emissions from construction-related activities associated with the recommended action may temporarily affect the air quality in the immediate vicinity of the proposed project area. However, BMP's, such as the periodic watering of loose soil, would be employed to minimize the release of dust into the air.

Noise

Construction-related activities are considered to be noise nuisances at nighttime on weekdays and anytime the sound level at or across a real property boundary exceeds 80 dBA. Daytime is defined as those hours from 6 am to 11 pm. Noise associated with the construction of this project is difficult to predict. Heavy machinery, the major source of noise in construction, would be constantly moving in unpredictable patterns. However, no extended disruption of normal activities would be expected. Furthermore, every reasonable effort would be made to minimize construction noise through abatement measures such as work-hour controls and proper maintenance of muffler systems. In addition, soil berms on banks would significantly reduce noise transmission.

Socioeconomic and Environmental Justice

In accordance with the provisions of Executive Order 12898, the recommended action would not substantially affect human health or the environment. Furthermore, the recommended action would not have the effect of excluding persons from participation in, deny persons the benefits of, or subject persons to discrimination under the recommended action because of their race, color, or national origin.

Executive Order 13045, Protection of Children

The recommended project would provide some benefit to children by improving the general quality of the environment in or near the project location.

Aesthetic Resources

The recommended restoration project would undoubtedly improve the aesthetic perception of Walnut Branch by providing a lush greenway through urban Seguin. Native vegetation plantings along the upper reach would most likely be a substantial improvement over the grass lined flood channel. Enjoyment of the natural landscape within Walnut Branch, as well as, bird and other wildlife viewing opportunities would be greatly improved by the restoration project. A primitive nature trail as proposed by the city would provide access to the restoration area without detracting from the restoration benefits.

Irreversible and Irretrievable Commitments of Resources

The recommended action would not entail any significant irretrievable or irreversible commitments of resources. Construction of the habitat improvements would require minor consumption of petroleum products, and importing materials such as rock, soil, gravel, and vegetation. However, the recommended action would entail long-term commitment and environmental stewardship to ensure the long-term sustainability of restored environmental resources.

Mitigation Requirements

Because of the nature of the proposal for ecosystem restoration no habitat mitigation would be required with the implementation of the recommended action.

9. REGULATORY REQUIREMENTS*

This EA was prepared in accordance with the Federal laws and executive orders listed below.

Archeological and Historic Preservation Act
Clean Water Act, Sections 404 and 401
Endangered Species Act
Fish and Wildlife Coordination Act
Executive Order 11988 - Floodplain Management
Executive Order 11593 - Protection and Enhancement of the Cultural Environment
Executive Order 11990 - Protection of Wetlands
Executive Order 12898 - Federal Actions to Address Environmental Justice in Minority and Low-Income Populations

The recommended project is in compliance with all applicable state of Texas and Federal cultural resources and environmental laws and regulations. The proposed activities for the Walnut Branch restoration project are consistent with the requirements for Nationwide Permit 27 (Stream and Wetland Restoration Activities) and therefore in compliance with Section 404 of the Clean Water Act. Initial coordination letters concerning restoration project have been sent to the U.S. Fish and Wildlife Service (USFWS) and the State Historic Preservation Office (SHPO). Development of the recommended plan was accomplished with substantial input from the USFWS. Coordination with the SHPO is ongoing and any action taken to implement the project will be in accordance with the SHPO approval.

10. PUBLIC INVOLVEMENT*

Pubic Involvement

Input from Walnut Branch Committee of the city of Seguin was obtained at the outset of this project and at several committee meetings during plan formulation. These committee meetings were open to the public and were attended by citizens of Seguin on multiple occasions.

Sponsor Views

The city of Seguin has indicated their intent to participate in the implementation of the recommended project including project cost sharing and operation and maintenance responsibilities.

Results of Agency Coordination

During formulation of the alternatives the Texas Parks and Wildlife Department (TPWD), U. S. Fish and Wildlife Service (USFWS) and Texas State Historic Preservation Office (TSHPO) visited the project are and were briefed on possible restoration measures that could be implemented. TPWD and USFWS were instrumental in developing restoration measures and determining habitat benefits for those measures. Coordination with the TSHPO is ongoing and project implementation will not begin without concurrence from them.

CONCLUSION

This Planning Design Report (PDR) documents the results of a study conducted under the authority of Section 206 of the Water Resources Development Act of 1986, as amended (33 USC 2201). The purpose of the study was to identify the causes of degradation within Walnut Branch, identify opportunities to improve the functional stability and integrity of the important ecological resources, evaluate measures to implement those improvements and recommend a cost effective ecosystem restoration project, if applicable.

The recommended restoration project would restore the riparian corridor, stream riffle-pool complexes, and vegetation within Walnut Branch to a less degraded, more natural condition. Habitat values within the project area would increase 380% for riparian and emergent wetland habitats and 190% for in-stream habitats over without project conditions. The restoration would benefit all resident and migratory wildlife along the stream corridor. Tree and ground cover plantings would restore 27.6 acres of riparian forest that was lost to development and construction of flood reduction channels while control of approximately 5.8 acres of non-native plant species would maintain existing, very valuable, hardwood forest. Installation of small low water structures and modification of historic dams would return a large stretch of stream riffle-pool complexes to a more natural condition. Bank stabilization would also preserve riparian forest while preventing further siltation of the stream, resulting in higher water quality. The project would also create 0.5 acre of off-channel emergent wetland to increase the amount of this valuable habitat present in Walnut Branch.

Extensive coordination and input was obtained from the U. S. fish and Wildlife Service during the formulation of the recommended plan and the evaluation of outputs from restoration measures. The recommended plan is consistent with state and Federal government initiatives to conserve and increase declining wetland and hardwood acreage.

The City of Seguin has been identified as the non-Federal Sponsor, and has been presented with the findings of this report. The city has pronounced their support of the project, including cost sharing and agreed to assume responsibilities for all operation, maintenance, replacement and repair costs.

11. LIST OF APPENDIXES

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Haynes, D. and R.R. McKown. 1974. A new species of map turtle (Genus Graptemys) from the Guadalupe River system in Texas. Tulane Studies in Zoology and Botany 18(4):143-152.

Killebrew, F.C. 1991. Habitat characteristics and feeding ecology of Cagle's map turtle (Graptemys caglei) within the proposed Cuero and Lindenau reservoir sites. Prepared for Texas Parks and Wildlife Department under interagency contract (91-483-797) with the Texas Water Development Board, Austin. 15 pp.

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U.S. Fish and Wildlife Service. 1980. The habitat evaluation procedures. USDI Fish and Wildlife Service, Ecological Services Manual 102.

List of Agencies, Organizations, and Persons to Whom Copies of the Statement will be Sent

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References Cited

Dixon, J.R. 1987. Amphibians and reptiles of Texas with keys, taxonomic synopses, bibliography, and distribution maps. Texas A&M University Press, College Station. 434 pp.

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APPENDIX A
Pertinent Correspondence

APPENDIX B
Habitat Evaluation Procedure and Analysis

APPENDIX C
Cultural Resources Information

APPENDIX D
HTRW Database Search

(Available upon request)

APPENDIX E
Public Review Comments

APPENDIX F
Project Cooperation Agreement

APPENDIX G
Hydrology and Hydraulics Analysis

WALNUT BRANCH 206
SEGUIN, TEXAS
SUMMARY STABILITY ANALYSIS
HYDROLOGY AND HYDRAULICS SECTION
MAY 2003

Description of Project Basin

- Located within City of Seguin, Texas in central Guadalupe County
- Walnut branch originates approximately 6.5 miles northwest of Seguin
- Walnut Branch flows from it's origin through the center of Seguin to confluence with Guadalupe River at river mile 255
- Drainage area is 7.28 square miles
- Basin length is approximately 7 miles
- Maximum basin width approximately 2 miles
- Elevation of Walnut Branch varies from 600 feet NGVD to 437 feet NGVD at the Guadalupe River
- The upper portion of watershed is sparsely developed, predominantly agriculture - the lower portion of the watershed is urbanized

Physiography and Geology

- Located in Blackland Prairie section of the Gulf Coastal Plain Province
- Primary strata consists of sedimentary deposits of predominantly dark gray clay shale beds with sand and silt interbeds
- In the Walnut Branch floodplain the clay shale bedrock is overlain by approximately 25-35 feet of alluvial material. The overburden material consists of ± 5 feet thick surface stratum of dark gray, organic clay, underlain by a ±25 feet thick sandy unit with variable amounts of clay, silt, and gravel

U.S. Army Corps of Engineers Flood Control Project

- Walnut Branch Federal flood control project is located at the upper reach of Walnut Branch
- Channel design is the 10-year flood
- Channel is approximately 1.3 miles long, channel bottom width varies from 50-70 feet, depth of channel (from channel bottom to top of bank) is approximately 5 feet
- Channel is grass-lined
- Project completed in 1991
- Field inspections of project after July 2002 record flows indicate project is in good condition. Several small isolated bank scour locations were observed. Riprap stone protection areas near bridges indicated some stone displacement. No sediment deposition was observed.

Hydrology

- Seguin experienced a major flood event in July 2002
- Peak flood event discharges are as follows:

	2-year flood (cfs)	25-year flood (cfs)
upper reach	800	3650
lower reach	800	3450

- Peak flood event discharges will not change due to the proposed 206 project modifications

Walnut Branch Channel Characteristics – Project Reach

- Walnut Branch channel cross-section geometry changes as it proceeds to the Guadalupe River – the creek deepens as the channel bank heights are more than 20+ feet

- In the reach of the proposed channel dam modifications (from Court Street to Austin Street) the channel bottom slope is approximately 0.0073 ft/ft

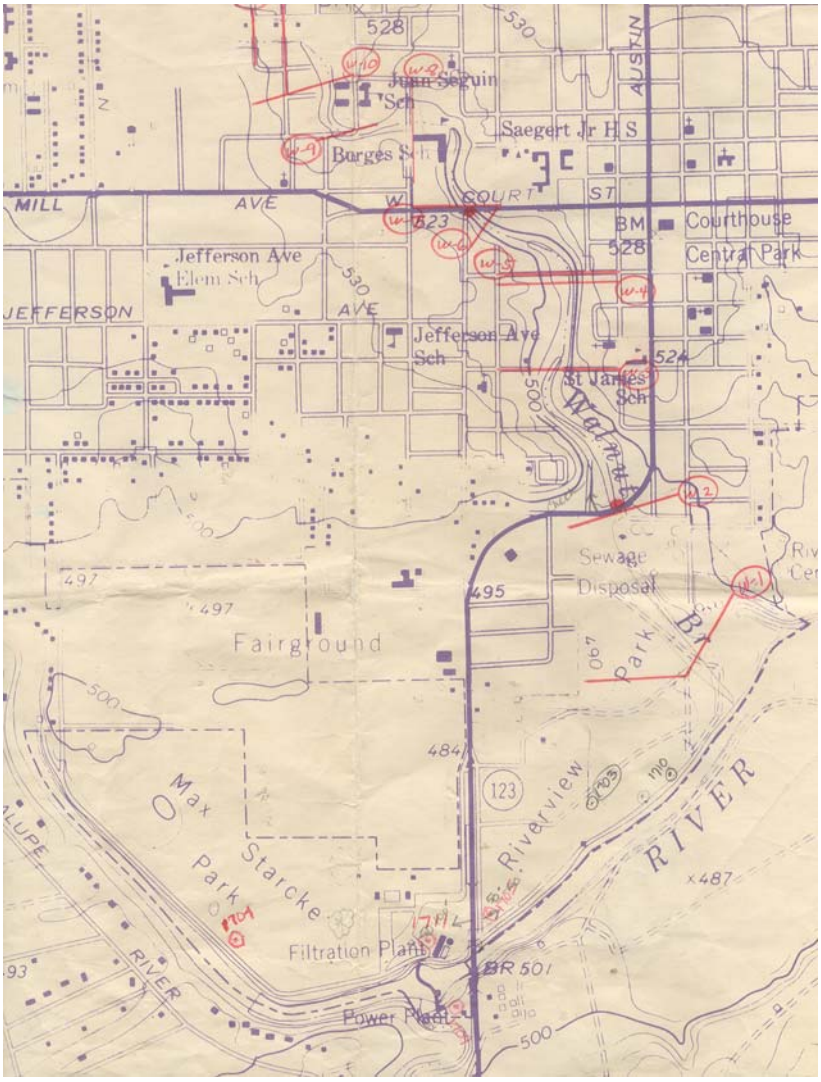
- Several channel dam structures have been constructed in the Court Street – Austin Street reach. These structures were constructed in the 1930's under the WPA program. These structures function as a creek stability mechanism to hold the slope of the creek bottom from the general forces of degradation as the creek flows down to the Guadalupe River. These dams prevent potential headcutting of the channel from progressing upstream.

- Channel bank capacity varies in the lower reach. Generally the bank full capacity can be assigned as the 25-year flood event.

- Existing instabilities include bank erosion at several points along the creek. Point erosion was exacerbated by the July 2002 flood.

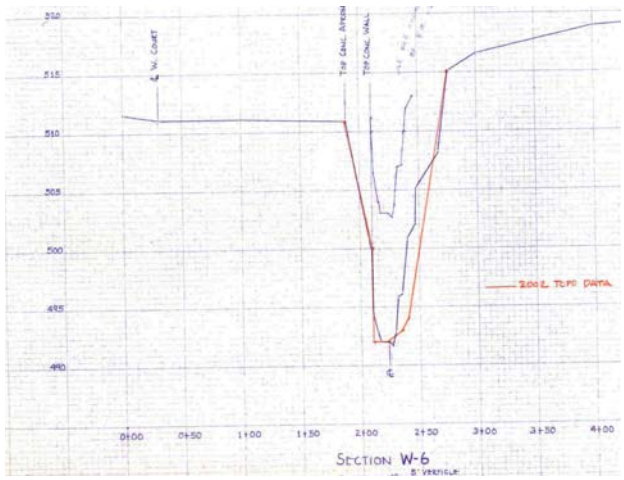
Channel dams

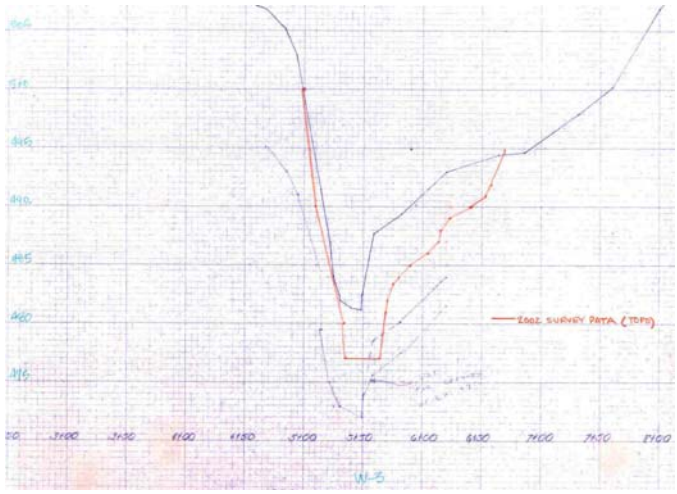
- As part of the erosion assessment, available Walnut Branch circa 1980 field surveys were compared to 2002 digitized topographic data of Walnut Branch. Limitations on this analysis consisted of accurately (within an acceptable range) overlaying the location of the 1980 survey cross-sections to the 2002 data. The location map of the cross-sections and the comparative cross-sections is included below.



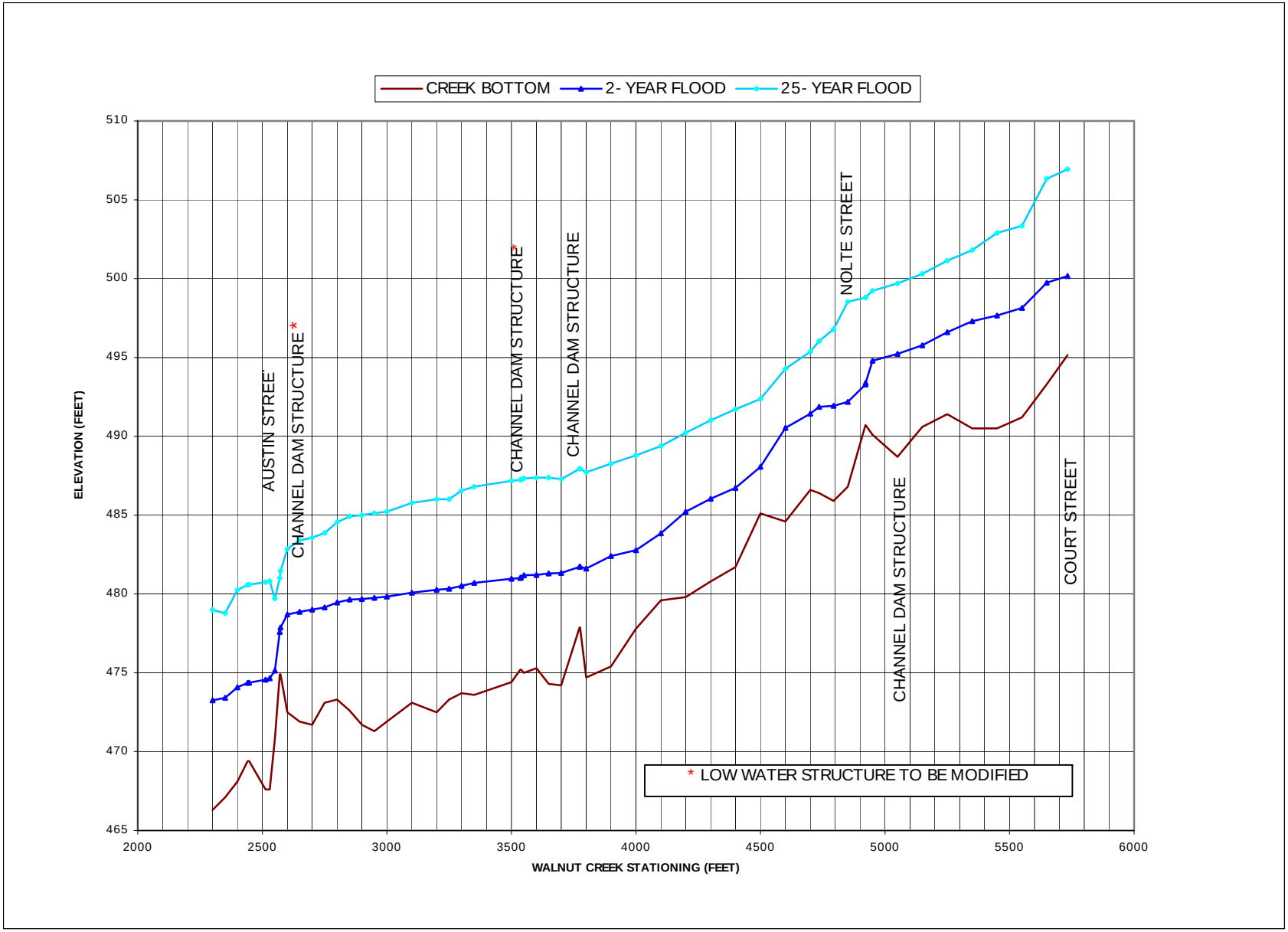
Cross-section survey map

Given the uncertainty of the analysis, and the possible man-made alterations in the floodplain that could account for some of these observed changes in the cross-section geometry, these three plots indicate some erosion occurring the past 20+ years, but within reasonable limits given the time period and the frequency of floods.





Cross-section plots



Water surface profiles for the 2-year flood and 25-year flood in the lower reach of Walnut Branch

Channel Dam Modifications

- The proposed modifications to the channel dams consists of the following:

    - At the channel dam located at station 2570, three 4-inch diameter holes will be drilled into the structure to low the upstream pool elevation 18-inches

    - At the channel dam located at station 3535, a notch will be chiseled into the structure to lower the upstream pool 12-inches

- These channel dam modifications were represented into the Walnut Branch HEC-RAS backwater model. Digitized 2002 topography was used to develop the model. The proposed channel bank erosion measures were not incorporated into the backwater model. The results of the comparative analysis for the 2-year flood and 25-year flood indicates that modifications to the channel dam structures will have very minor impacts to the upstream water surface elevations and channel velocities. The channel velocities increases are less than 0.05 ft/sec. The following table summarizes the HEC-RAS output comparisons.

COMPARISON OF PROPOSED CHANNEL DAM MODIFICATIONS ON THE WATER SURFACE

ELEVATIONS AND CHANNEL VELOCITY FOR THE 2-YEAR FLOOD AND 25-YEAR FLOOD

		2-YEAR EXISTING		2-YEAR PROPOSED		CHANGE	
Creek Station	Discharge (cfs)	WSEL (ft)	Velocity Channel (ft/s)	WSEL (ft)	Velocity Channel (ft/s)	WSEL (ft)	Velocity Channel (ft/s)
2300	800	473.25	4.60	473.25	4.60	0.00	0.00
2350	800	473.41	6.29	473.41	6.29	0.00	0.00
2400	800	474.08	4.55	474.08	4.55	0.00	0.00
2441	800	474.36	4.19	474.36	4.19	0.00	0.00
2447	800	474.38	4.16	474.38	4.16	0.00	0.00
2478	Austin Street						
2513	800	474.56	5.06	474.56	5.06	0.00	0.00
2530	800	474.66	4.93	474.66	4.93	0.00	0.00
2550	800	475.14	9.28	475.14	9.28	0.00	0.00
2570	800	477.60	8.31	477.58	8.28	-0.02	-0.03
2573	800	477.88	7.34	477.84	7.36	-0.04	0.02
2600	800	478.70	3.62	478.67	3.64	-0.03	0.02
2650	800	478.87	3.55	478.84	3.57	-0.03	0.02
2700	800	479.01	3.69	478.97	3.72	-0.04	0.03
2750	800	479.15	4.33	479.11	4.38	-0.04	0.05
2800	800	479.46	3.43	479.42	3.46	-0.04	0.03
2850	800	479.64	2.56	479.61	2.58	-0.03	0.02
2900	800	479.68	3.19	479.65	3.21	-0.03	0.02
2950	800	479.75	3.50	479.72	3.52	-0.03	0.02
3000	800	479.84	3.54	479.81	3.56	-0.03	0.02
3100	800	480.09	2.98	480.07	3.00	-0.02	0.02
3200	800	480.27	3.12	480.24	3.14	-0.03	0.02
3250	800	480.33	3.76	480.31	3.78	-0.02	0.02
3300	800	480.52	3.31	480.50	3.32	-0.02	0.01
3350	800	480.70	2.68	480.68	2.69	-0.02	0.01
3500	800	480.97	2.55	480.96	2.56	-0.01	0.01
3535	800	481.02	3.38	481.01	3.34	-0.01	-0.04
3538	800	481.04	3.38	481.03	3.31	-0.01	-0.07
3550	800	481.18	2.07	481.16	2.07	-0.02	0.00
3600	800	481.21	2.92	481.19	2.94	-0.02	0.02
3650	800	481.30	3.56	481.28	3.58	-0.02	0.02
3700	800	481.33	4.86	481.32	4.87	-0.01	0.01
3774	800	481.72	3.66	481.71	3.68	-0.01	0.02
3776	800	481.73	3.66	481.71	3.67	-0.02	0.01
3800	800	481.60	5.77	481.59	5.79	-0.01	0.02

3900	800	482.40	3.91	482.39	3.91	-0.01	0.00

		2-YEAR EXISTING		2-YEAR PROPOSED		CHANGE	
Creek Station	Discharge	WSEL	Velocity Channel	WSEL	Velocity Channel	WSEL	Velocity Channel
	(cfs)	(ft)	(Ft/s)	(ft)	(ft/s)	(ft)	(ft/s)
4000	800	482.78	4.81	482.78	4.81	0.00	0.00
4100	800	483.84	5.98	483.84	5.99	0.00	0.01
4200	800	485.22	4.87	485.22	4.87	0.00	0.00
4300	800	486.04	4.43	486.04	4.43	0.00	0.00
4400	800	486.72	4.14	486.72	4.14	0.00	0.00
4500	800	488.06	8.06	488.07	8.02	0.01	-0.04
4600	800	490.53	4.68	490.52	4.69	-0.01	0.01
4700	800	491.43	5.18	491.43	5.18	0.00	0.00
4735	800	491.87	3.37	491.87	3.37	0.00	0.00
4765	Nolte Street						
4793	800	491.93	3.91	491.93	3.91	0.00	0.00
4850	800	492.18	4.01	492.18	4.01	0.00	0.00
4921	800	493.28	7.60	493.28	7.60	0.00	0.00
4922	800	493.40	7.56	493.40	7.56	0.00	0.00
4950	800	494.80	3.36	494.80	3.36	0.00	0.00
5050	800	495.23	3.60	495.23	3.60	0.00	0.00
5150	800	495.78	4.54	495.78	4.54	0.00	0.00
5250	800	496.60	4.77	496.60	4.77	0.00	0.00
5350	800	497.29	3.87	497.29	3.87	0.00	0.00
5450	800	497.65	3.63	497.65	3.63	0.00	0.00
5550	800	498.13	6.87	498.13	6.87	0.00	0.00
5650	800	499.73	4.71	499.73	4.71	0.00	0.00
5733	800	500.15	4.72	500.15	4.72	0.00	0.00
5779	Court Street						

Location of channel dam modifications

COMPARISON OF PROPOSED CHANNEL DAM MODIFICATIONS ON THE WATER SURFACE ELEVATIONS AND CHANNEL VELOCITY FOR THE 2-YEAR FLOOD AND 25-YEAR FLOOD

		25-YEAR EXISTING		25-YEAR PROPOSED		CHANGE	
Creek Station	Discharge (cfs)	WSEL (ft)	Velocity Channel (ft/s)	WSEL (ft)	Velocity Channel (ft/s)	WSEL (ft)	Velocity Channel (ft/s)
2300	3450	479.00	6.79	479.00	6.79	0.00	0.00
2350	3450	478.78	10.81	478.78	10.81	0.00	0.00
2400	3450	480.26	6.68	480.26	6.68	0.00	0.00
2441	3450	480.58	6.12	480.58	6.12	0.00	0.00
2447	3450	480.60	6.11	480.60	6.11	0.00	0.00
2478	Austin Street						
2513	3450	480.75	6.65	480.75	6.65	0.00	0.00
2530	3450	480.81	6.60	480.81	6.60	0.00	0.00
2550	3450	479.71	12.58	479.71	12.58	0.00	0.00
2570	3450	481.01	12.22	480.98	12.22	-0.03	0.00
2573	3450	481.45	11.15	481.42	11.14	-0.03	-0.01
2600	3450	482.85	7.42	482.82	7.45	-0.03	0.03
2650	3450	483.40	6.46	483.38	6.49	-0.02	0.03
2700	3450	483.56	7.20	483.54	7.22	-0.02	0.02
2750	3450	483.86	7.69	483.85	7.71	-0.01	0.02
2800	3450	484.55	6.05	484.54	6.06	-0.01	0.01
2850	3450	484.92	4.95	484.91	4.95	-0.01	0.00
2900	3450	484.99	5.87	484.98	5.87	-0.01	0.00
2950	3450	485.12	6.37	485.11	6.38	-0.01	0.01
3000	3450	485.21	6.95	485.20	6.96	-0.01	0.01
3100	3450	485.78	5.10	485.77	5.10	-0.01	0.00
3200	3450	486.00	5.73	486.00	5.73	0.00	0.00
3250	3450	486.01	6.89	486.00	6.89	-0.01	0.00
3300	3450	486.55	5.17	486.55	5.18	0.00	0.01
3350	3450	486.80	4.55	486.79	4.55	-0.01	0.00
3500	3450	487.18	4.01	487.18	4.02	0.00	0.01
3535	3450	487.23	4.18	487.23	4.17	0.00	-0.01
3538	3450	487.25	4.14	487.24	4.11	-0.01	-0.03
3550	3450	487.33	3.69	487.33	3.69	0.00	0.00
3600	3450	487.37	3.99	487.37	3.99	0.00	0.00
3650	3450	487.37	5.15	487.37	5.15	0.00	0.00
3700	3450	487.28	7.46	487.28	7.46	0.00	0.00
3774	3450	487.94	4.00	487.93	4.00	-0.01	0.00
3776	3450	487.94	3.99	487.94	4.00	0.00	0.01
3800	3450	487.72	7.04	487.71	7.05	-0.01	0.01
3900	3450	488.26	6.59	488.25	6.59	-0.01	0.00

		25-YEAR EXISTING		25-YEAR PROPOSED		CHANGE	
Creek Station	Discharge (cfs)	WSEL (ft)	Velocity Channel (ft/s)	WSEL (ft)	Velocity (ft/s)	WSEL (ft)	Velocity Channel (ft/s)
4000	3450	488.79	6.05	488.78	6.05	-0.01	0.00
4100	3450	489.38	6.79	489.38	6.79	0.00	0.00
4200	3450	490.22	6.90	490.22	6.90	0.00	0.00
4300	3450	491.01	6.59	491.01	6.60	0.00	0.01
4400	3450	491.72	6.50	491.72	6.50	0.00	0.00
4500	3450	492.36	9.13	492.36	9.13	0.00	0.00
4600	3450	494.28	7.52	494.28	7.52	0.00	0.00
4700	3450	495.37	8.44	495.37	8.44	0.00	0.00
4735	3450	496.04	7.11	496.04	7.11	0.00	0.00
4765	Nolte Street						
4793	3450	496.79	9.21	496.79	9.21	0.00	0.00
4850	3450	498.52	5.54	498.52	5.54	0.00	0.00
4921	3450	498.79	6.38	498.79	6.38	0.00	0.00
4922	3450	498.80	6.42	498.80	6.42	0.00	0.00
4950	3450	499.22	5.57	499.22	5.57	0.00	0.00
5050	3450	499.69	6.38	499.69	6.38	0.00	0.00
5150	3450	500.29	7.01	500.29	7.01	0.00	0.00
5250	3450	501.13	6.93	501.13	6.93	0.00	0.00
5350	3450	501.80	7.88	501.80	7.88	0.00	0.00
5450	3450	502.89	5.84	502.89	5.84	0.00	0.00
5550	3450	503.34	11.69	503.34	11.69	0.00	0.00
5650	3450	506.33	7.27	506.33	7.27	0.00	0.00
5733	3450	506.94	7.18	506.94	7.18	0.00	0.00
5779	Court Street						

Location of channel dam modifications

Quantitative Analysis Approach

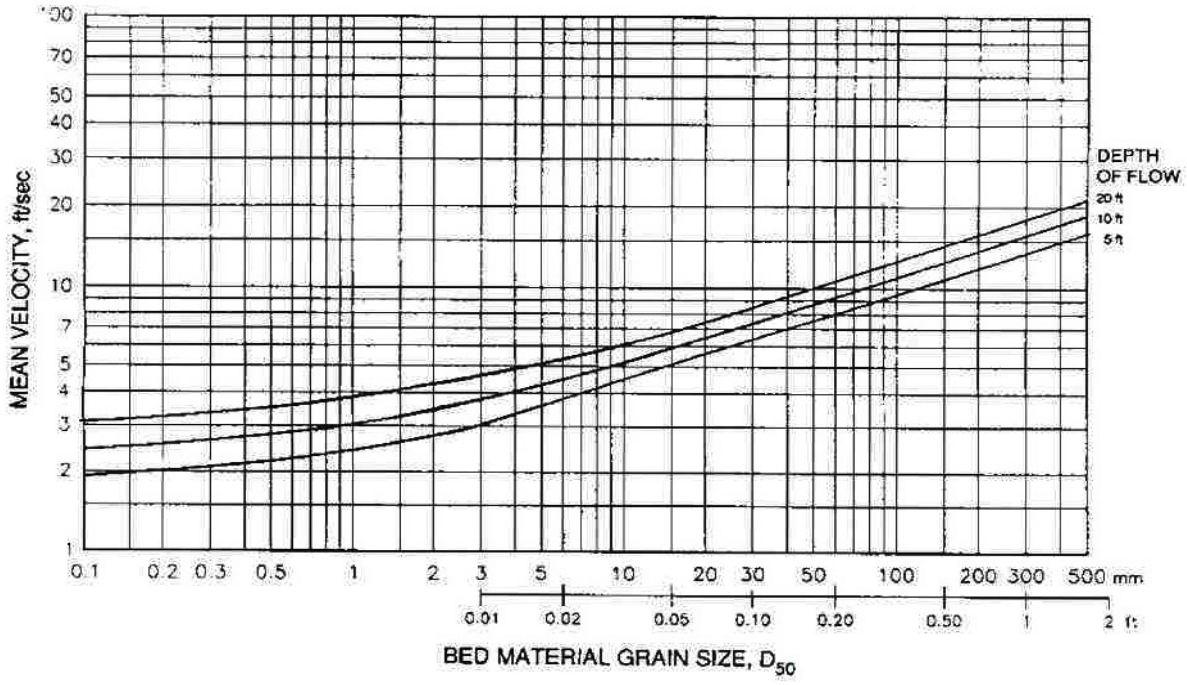
- Analysis was performed on the Walnut Branch channel to determine channel sediment/erosion parameters. The following table lists output from Walnut Branch HEC-RAS backwater model:

Creek Station	Discharge (cfs)	WSEL (ft)	Velocity Channel (ft/s)	Top Width Channel (ft)	Hydraulic Radius (ft)
2300	3450	479	6.79	53.62	7.5
2350	3450	478.78	10.81	33.31	6.03
2400	3450	480.26	6.68	69.1	6.8
2441	3450	480.58	6.12	69.71	7.33
2447	3450	480.6	6.11	69.77	7.34
2478	Austin Street				
2513	3450	480.75	6.65	78.3	6.10
2530	3450	480.81	6.60	78.89	6.11
2550	3450	479.71	12.58	53.39	4.69
2570	3450	480.98	12.22	60.79	4.17
2573	3450	481.42	11.14	62.1	4.46
2600	3450	482.82	7.45	60.0	6.77
2650	3450	483.38	6.49	63.6	7.07
2700	3450	483.54	7.22	68.14	6.34
2750	3450	483.85	7.71	64.88	6.31
2800	3450	484.54	6.06	77.16	6.97
2850	3450	484.91	4.95	75.58	8.52
2900	3450	484.98	5.87	51.69	8.57
2950	3450	485.11	6.38	42.7	9.08
3000	3450	485.2	6.96	35.1	10.03
3100	3450	485.77	5.1	87.64	7.31
3200	3450	486	5.73	58.3	9.11
3250	3450	486	6.89	56.69	7.75
3300	3450	486.55	5.18	86.62	7.30
3350	3450	486.79	4.55	89.63	8.00
3500	3450	487.18	4.02	97.72	8.09
3535	3450	487.23	4.17	104.65	7.37
3538	3450	487.24	4.11	106.87	7.33
3550	3450	487.33	3.69	81.9	10.31
3600	3450	487.37	3.99	80.38	9.01
3650	3450	487.37	5.15	48.7	9.34
3700	3450	487.28	7.46	26.5	9.26
3774	3450	487.93	4.00	137.57	6.12
3776	3450	487.94	4.00	137.63	6.13
3800	3450	487.71	7.05	44.1	7.74
3900	3450	488.25	6.59	45.38	8.48
4000	3450	488.78	6.05	84.76	6.37

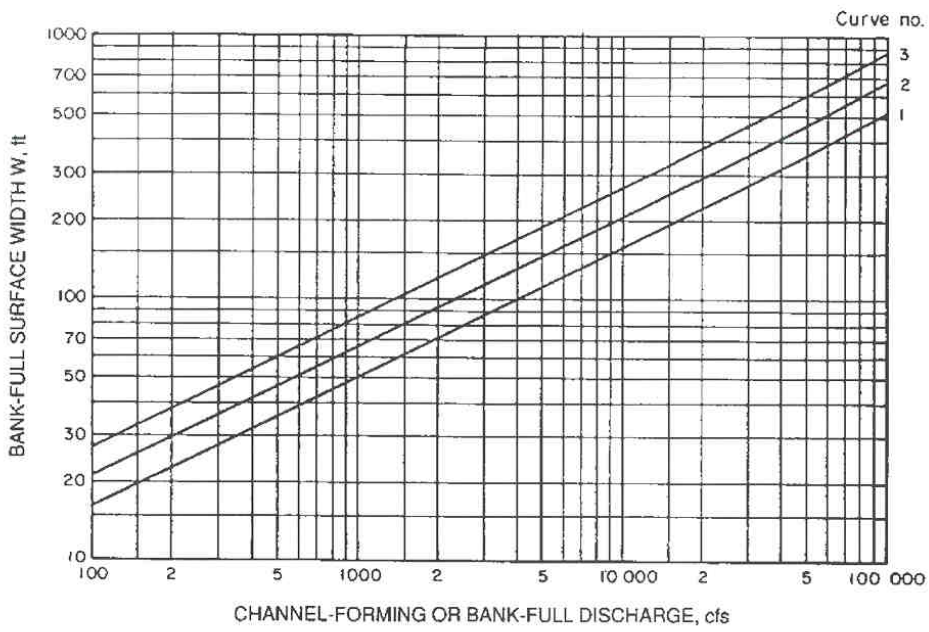
Creek Station	Discharge (cfs)	WSEL (ft)	Velocity Channel (ft/s)	Top Width Channel (ft)	Hydraulic Radius (ft)
4100	3450	489.38	6.79	87.59	5.61
4200	3450	490.22	6.90	76.5	5.92
4300	3450	491.01	6.60	84.19	5.98
4400	3450	491.72	6.50	83.42	6.09
4500	3450	492.36	9.13	79.26	4.64
4600	3450	494.28	7.52	91.76	4.86
4700	3450	495.37	8.44	78.9	4.93
4735	3450	496.04	7.11	63.98	6.86
4765	Nolte Street				
4793	3450	496.79	9.21	35.42	6.78
4850	3450	498.52	5.54	69.48	8.09
4921	3450	498.79	6.38	91.66	5.7
4922	3450	498.8	6.42	92.18	5.6
4950	3450	499.22	5.57	96.83	6.18
5050	3450	499.69	6.38	67.4	7.17
5150	3450	500.29	7.01	75.77	6.05
5250	3450	501.13	6.93	81.1	5.9
5350	3450	501.8	7.88	39.1	8.88
5450	3450	502.89	5.84	59.84	7.72
5550	3450	503.34	11.69	43.6	5.38
5650	3450	506.33	7.27	33.0	9.07
5733	3450	506.94	7.18	59.54	6.26
5779	Court Street				

- The average channel velocity within the lower reach is approximately +6 ft/s. The high channel velocities noted at stationing 2500-2570 occur at the downstream channel dam and apron. Field observation noted some scouring on the structure apron. Further investigation of this structure and apron is needed - it is likely that repair of the apron is required and should be included as part of the overall structural measures proposed during the course of this study.

- Assuming a average bed material grain size of ±10 mm, and a depth of flow at the 25-year discharge of approximately 20 feet, the mean stable velocity determined from the chart below is 6 ft/s. This matches very closely with the computed velocity from the backwater model.



- Using the bank-full discharge of approximately 3500 cfs and Curve 2 of the chart below, the bank-full surface width from the figure below is approximately 125 feet. This is generally larger than the computed channel top width from the HEC-RAS backwater model.



TENTATIVE GUIDANCE: CURVE 1: STIFF COHESIVE OR VERY COARSE GRANULAR BANKS.
CURVE 2: AVERAGE COHESIVE OR COARSE GRANULAR BANKS.
CURVE 3: SANDY ALLUVIAL BANKS.

SEE PARAGRAPH 5-5 FOR LIMITATIONS.

FORMULA: $W = C\,Q^{0.5}$ WITH $C = 1.6, 2.1, 2.7$

Summary of Findings

- The above analysis indicates that the proposed modifications to the two channel dams will not cause stream bank erosion or further promote bank failures. Summary of the pertinent data which this decision is based are as:

    1. The hydrology will not change

    2. The four (4) existing channel dams will remain, functioning as grade control structures

    3. Historical cross-sections data indicate minimal erosion in the past 20+ years

    4. Incorporating the two channel dam modifications in the HEC-RAS model indicate no increase in upstream channel velocity

    5. A stable channel velocity has been achieved, given the median grain size and depth of flow

Limitations of Stability Analysis

- Further assessment of the Walnut Branch channel soil and bank material is required to acquire information to be used as input for a more detailed analytical analysis, if desired. Soil testing to determine median grain size of the creek bed material and bank material needs to be completed.

- Analytical tools, such as the SAM Hydraulic Design Package for Channels, could be used to analyze a range of different channel conditions. Parameters, such as bank-full discharge, bed sediment grain size, bed sediment concentration, and roughness of banks, are used by the SAM program to produce analytical predictions of sediment transport and potential erosion.

APPENDIX H
Civil Design Narrative and Drawings

CIVIL SECTION

1. The following proposals represent typical erosion protection and environmental enhancement solutions that are to be applied to these and other sites on Walnut Branch, where appropriate.
2. Site A (Wetland) - This site is located on the north side of Walnut Creek between Sanders Street and Guadalupe Street. The existing creek bank has a mild slope in this area. An existing storm drain extends along the east side of Sanders street and discharges into Walnut Creek. Natural springs in this area result in a small but constant discharge from the storm drain. The proposed wetland would be excavated on the north bank of the creek. The upstream end of the wetland would be supplied with diverted discharge from the storm drain. A manhole would be constructed at the storm drain with a weir to pond water to elevation 507. A discharge pipe would be constructed from the manhole (on the upstream side of the weir) to the upstream end of the wetland pond. Excess storm runoff would flow over the weir and be discharged into the creek, as it is currently. Access to this site is available from Sanders Street. A plan view of the site is attached.
3. Site B –
    a. This site is located on the east bank of Walnut Branch, between Convent Street and Shelby Street. This site has slopes that vary between approximately 6 horizontal to 1 vertical and 1.5 horizontal to 1 vertical. The bank is approximately 14’ high. Erosion at the toe of the slope is threatening to undermine the creek bank. The proposed repair involves protecting the toe of slope with 12” thick rock riprap with 6” thick bedding. The riprap and bedding would be placed for approximately 120’ along the bank on a slope of 2 horizontal to 1 vertical. The proposed design for this site is shown on the attached drawing in typical section 3. A plan view is also attached. Access to the site is available from Shelby Street on the east side of the creek.
    b. A crib structure is also proposed for this site. The crib structure will act as a grade control and will provide a constant pool of water upstream for improved environmental habitat. The pool will be supplied by the natural low flows from the creek. The structure will consist of a reinforced concrete weir (8’x30’x2’), covered and surrounded by 18” native stone riprap. The structure will be founded on 18” of crushed limestone. Rock stepping-stones will be staggered across the structure to provide a pedestrian crossing. A plan and section of the structure is shown on the attached drawing.
4. Site C – Slope protection - This site is located on the east bank, where Convent Street intersects Walnut Branch. This site has an existing creek bank with a slope of approximately 1.5 horizontal to 1 vertical. The bank is approximately 30’ high. A slope failure at the toe of the existing slope is threatening the stability of the remaining slope. The proposed repair involves protecting the toe of slope for approximately 150’ with a combination of 18” rock riprap and stone blocks. This will provide both erosion protection and add stability to the repaired area. Temporary shoring will be used as necessary during construction to prevent

destroying the existing slope. Access to this site will be available from Convent Street on the west bank. The proposed typical sections 1 and 2, as shown on the attached drawings, will be used on this site. A plan view is also attached.

APPENDIX I
Real Estate Plan

WALNUT BRANCH AQUATIC RESTORATION PROJECT
SEGUIN, TEXAS, GUADALUPE COUNTY

1. PURPOSE

The following Real Estate Plan (REP) supports the feasibility study. All project lands will be owned in fee by the sponsor, city of Seguin, Texas. Authority for the project is Section 206 of the Water Resources Development Act of 1996, Public Law 104-303, which authorizes the Secretary of the Army to carry out aquatic ecosystem restoration and protection. The total project is located within the city limits of Seguin, Texas. The purpose of the project is to restore the riparian corridor, stream riffle-pool complexes, and vegetation within Walnut Branch to benefit all resident and migratory wildlife along the stream corridor. Specific restoration activities include planting approximately 27.6 acres of riparian forest; control of approximately 5 acres of non-native plant species and replacement with high quality native trees and undercover plants; installation of small low water structures; modification of historic dams to restore 550 linear feet of riffle-pool complexes; removal of some large concrete debris within the natural channel and bank stabilization of approximately 600 feet of bank using native stone. The project will also create 0.5 acre of off-channel emergent wetland to increase the amount of this valuable habitat present in Walnut Branch.

2. LAND, EASEMENT, AND RIGHT OF WAY FOR RECOMMENDED PLAN.

FEE LAND OWNERSHIP
37.74 acres

3. COST SHARE OF PROJECT

Estimate Value of Lands:

ESTATE	ACRES	ESTIMATED VALUE
Fee Title (excluding 3rd party minerals)	37.74	$207,500
Minerals (3rd party)	37.74	$ 3,775
Damages		$ 21,128
Contingency		$ 69,721

Total	$ 302,124
Rounded to	$ 305,000

The cost-share for this restoration project is 65% Federal and 35% for the city of Seguin.

4. NON-STANDARD ESTATES

There are no non-standard estates associated with this project. Fee estate is the only estate required for this ecosystem restoration.

5. EXISTING FEDERAL PROJECT

There is no existing Federal project that lies fully or partially within the project.

6. FEDERALLY OWNED LAND

There are no Federally owned lands associated with the project.

7. NAVIGATIONAL SERVITUDE

There is no navigational servitude associated with this project. The Walnut Branch Creek is not a navigable stream.

8. ADDITIONAL INFORMATION AND MAP

There are no HTRW lands in the project area. This has been verified by staff personnel in the Planning, Environmental and Regulatory Division of this District. Attached are maps of the project area.

9. FLOODING OF THE PROJECT AREA

There will be no flooding to private property caused by construction, and maintenance of the project.

10. BASELINE COST ESTIMATE FOR REAL ESTATE

Property values included in the cost estimate are based on appraisal dated 13 June 2003, prepared by Randy Roberts, appraiser, and approved by Rocky D. Lee, MAI, SRA, of the Real Estate Division, Fort Worth District on 16 June 2003. The Fort Worth Technical Resource Branch staff estimated administrative costs. Contingencies have been added to the cost estimates as follows:

01.23.03.01 Real Estate Planning Documents, 10% based on reasonable certainty of costs.

01.23.01.02 Real Estate Acquisition Documents, 10% based on reasonable certainty of costs.

01.23.03.03 Real Estate Condemnation Documents, 25% based on expectation of at least two condemnations.

01.23.03.05 Real Estate Appraisal Documents, 10% based on reasonable certainty of contract costs.

01.23.03.15 Real Estate Payment Documents, 10% based on contingencies assigned by the Appraiser in the appraisal.

01.23.03.17 Real Estate LERRD Accounting Documents, 25% based on reasonable certainty regarding accounting requirements.
Estimates are presented in the standard Code of Accounts from MCACES Model Database, October 1994. Costs are presented as follows:

ACCOUNT	DESCRIPTION	ESTIMATE	CONTINGENCY
01.23.03.01	RE Planning Documents	$ 30,000	$ 3,000
01.23.03.02	RE Acquisition Documents		
	Acquisition by Local Sponsor	$ 62,000	$ 6,200
	Review by Local Sponsor	$ 12,400	$ 1,240
01.23.03.03	RE Condemnation Documents		
	Condemnation by Sponsor	$ 90,000	$ 9,000
	Review by Sponsor	$ 12,000	$ 1,200
01.23.03.05	RE Appraisal Documents		
	Appraisal by Sponsor	$ 93,000	$ 9,300
	Review by Sponsor	$ 9,300	$ 930
01.23.03.15	RE Payment Document		
	Payment by Sponsor		
	Land	$ 207,500	$ 20,750
	Severance Damage	$ 21,128	$ 2,112
	Review by Sponsor	$ 2,000	$ 200
01.23.03.16	RE LERRD Accounting Documents	$ 2,000	$ 500

TOTAL ADMIN AND PAYMENT	$541,328
TOTAL CONTINGENCY	$ 54,432
GRAND TOTAL	**$595,760**

11. RELOCATION ASSISTANCE P.L. 91-646

There are no individual residences, farms, or businesses to be relocated in conjunction with this project.

12. MINERAL AND TIMBER ACTIVITY

There is no mineral exploration or merchantable timber activity in the project area. The city of Seguin's zoning ordinances will not allow mineral exploration or timber activity in the city limits. All minerals retained by the land owner were included in the land estimate. Minerals subordinated to 3rd party were estimated at $100 per acre.

13. COST SHARED PROJECT

The city of Seguin will acquire all required lands in fee associated with this restoration project. The city has the authority to acquire the lands needed for the project. The city has the authority to accomplish eminent domain should it be necessary. The city has been advised of Public Law 91-646 requirements and the requirements to document expenses for credit purposes.

14. ENACTMENT OF ZONING ORDINANCES

There are no special zoning ordinances proposed to be enacted on connection with this restoration project.

15. LAND ACQUISITION

There are 34.16 acres of land acquisitions required for completion of the project. Attached is a Track Listing of all the tracts within the project area.

16. FACILITY OR UTILITY RELOCATIONS

There will be no facility or utility relocation associated with this restoration project.

17.CONTAMINANTS ON REAL ESTATE ACQUISITIONS

Should lands be discovered with HTRW contaminants during the construction of the project, it will be the responsibility of the sponsor to clean up the site at their expense. The sponsor is aware of this provision.

18. OPPOSITION BY LANDOWNERS IN THE PROJECT AREA

No landowners in the project area have come forward to give negative responses concerning this project.

19. LAND ACQUISITION PRIOR TO PCA

The sponsor has been informed not to purchase any land prior to the PCA being signed.

20. RELEVANT ISSUES

There are no real estate issues relevant to planning, design, or implementing this project.

ASSESSMENT OF NON-FEDERAL SPONSOR'S

REAL ESTATE ACQUISITION CAPABILITY
WALNUT BRANCH AQUATIC RESTORATION PROJECT

1. Legal Authority:

a. Does the sponsor have legal authority to acquire and hold title to real property for project purposes? Yes

b. Does the sponsor have the power of eminent domain for this project? Yes

c. Does the sponsor have "quick take" authority for this project? Yes

d. Are any of the lands/interests in land required for the project located outside the sponsor's political boundary? No

e. Are any of the lands/interests in land required for project owned by an entity whose property the sponsor cannot condemn? No

II. Human Resources Requirements:

a. Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P.L. 91-646, as amended? No

b. Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? Yes

c. Is the sponsor's projected in-house staffing level sufficient considering its other work load, if any, and the project schedule? Yes

d. Can the sponsor obtain contractor support, if required in a timely fashion? Yes

e. Will the sponsor likely request USACE assistance in acquiring real estate? No

III. Other Project Variables:

a. Will the sponsor's staff be located within reasonable proximity of the project? Yes

b. Has the sponsor approved the project/real estate schedule/milestones? Yes

IV. Overall Assessment:

a. Has the sponsor performed satisfactorily on other USACE projects? Yes

b. With regard to this project, the sponsor is anticipated to be: Highly Capable

V. Coordination:

a. Has the assessment been coordinated with the sponsor? Yes

b. Does the sponsor concur with this assessment? Yes

Prepares by:

Russ Hendricks
Realty Specialist
Fort Worth District

_____
Date

Reviewed and approved by:

Bobby J. Camp
Acting Chief, Real Estate Division
Fort Worth District

_____
Date

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Russ Hendricks
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Fort Worth District

25 June 2003
Date

Reviewed and approved by:

Bobby J. Camp

Bobby J. Camp
Acting Chief, Real Estate Division
Fort Worth District

25 June 2003
Date