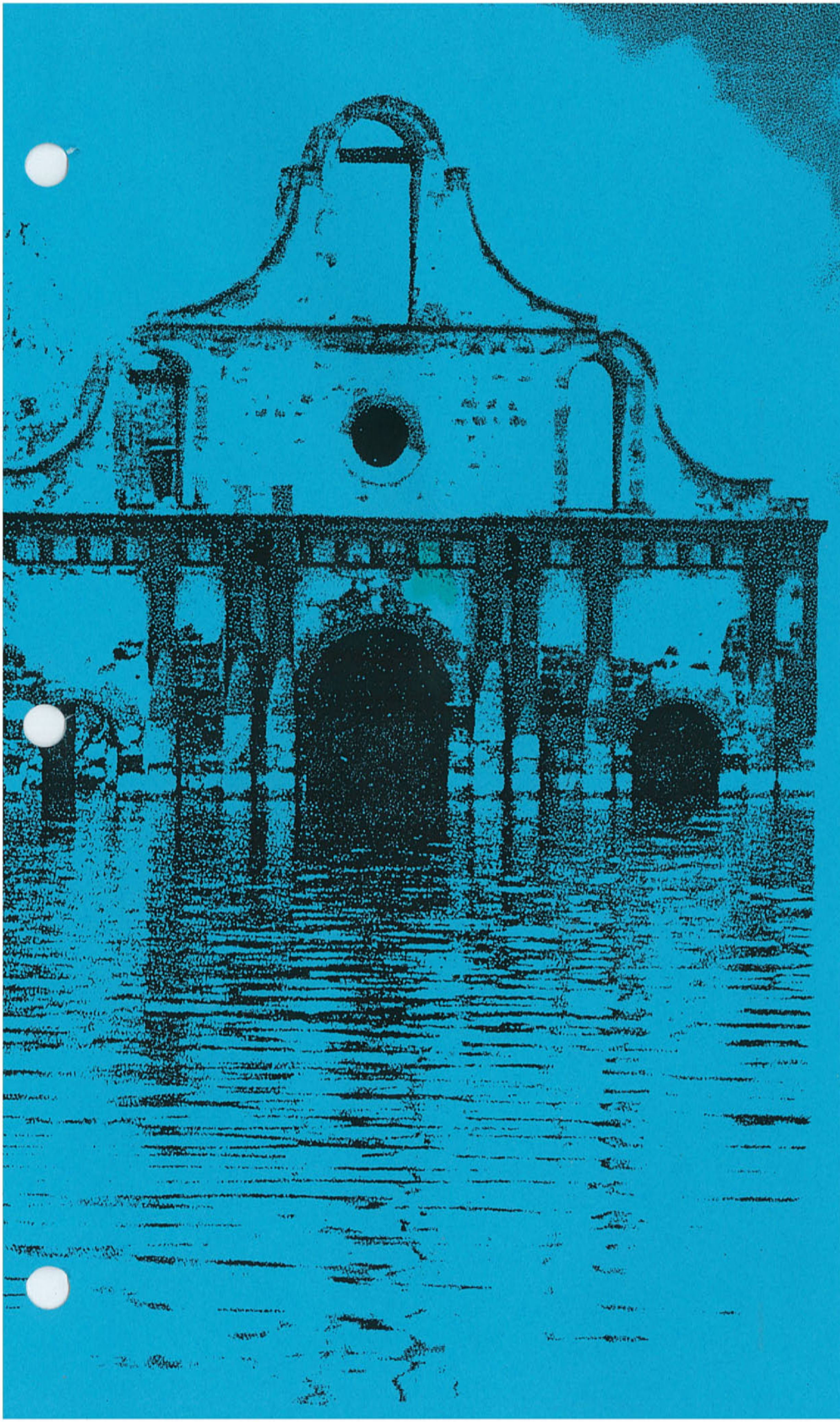

ZAPATA COUNTY

FLOOD PROTECTION PLANNING STUDY

TEXAS WATER DEVELOPMENT BOARD

CARLOS COLINA-VARGAS, AICP
& ASSOCIATES
Urban Planning and Management Consultants

July 16, 2009

Hon. Rosalva Guerra, County Judge
and Hon. Zapata County Commissioners
P.O. Box 99
Zapata, TX 78076-0099

RE: TWDB FLOOD PROTECTION PLANNING STUDY
TWDB CONTRACT No. 2003-484-490

Dear Judge Guerra and County Commissioners:

We are pleased to submit the accompanying report on the Flood Protection Planning Study project. This report presents the findings of the study, which was conducted with assistance from the Texas Water Development Board, for the purpose of providing information that will serve Zapata County in the efforts to prevent and mitigate flooding in Zapata and to eliminate the threat of damage and loss that could be caused on both public and private property if flooding occurs in that community.

Thank you for affording us the opportunity to conduct this planning project. We are grateful for the invaluable cooperation and input we received from the county staff members and from numerous other individuals who shared with us their knowledge of the community. We are proud of the plan that has been completed, and are gratified to play a role in providing information of substantial benefit to your ongoing efforts to construct improvements that enhance the quality of life in Zapata County.

Sincerely,

Carlos Colina-Vargas, AICP

CC-V:cwc

Enclosure

cc: Mr. Mario Gonzalez-Davis, Projects Coordinator

FLOOD PROTECTION PLANNING STUDY

PREPARED FOR

ZAPATA COUNTY

BY

CARLOS COLINA-VARGAS, AICP & ASSOCIATES

PLANNING AND MANAGEMENT CONSULTANTS

IN COOPERATION WITH

GARCIA & WRIGHT
CONSULTING ENGINEERS, INC.

2009

ABOUT THE COVER: Photo of *Templo de Nuestra Senora del Refugio* in Guerrero Viejo, Tamaulipas, Mexico. Although located in Mexico, this church inundated by the waters of Falcon Reservoir has become a symbol of the region, the displacement which occurred with the construction of the reservoir, and the determination of the region's people to succeed under the most adverse conditions. Completely under water when the reservoir's levels are normal, during periods of severe drought the church emerges into the borderland sun to stand again on dry ground.

Photograph: Rose Trevino, Los Caminos Del Rio Heritage Project publication, Texas Historical Commission.

ZAPATA COUNTY

COMMISSIONERS COURT

Hon. Rosalva Guerra	County Judge
Hon. Jose Emilio Vela	County Commissioner, Precinct #1
Hon. Gabriel Villarreal	County Commissioner, Precinct #2
Hon. Joe Rathmell	County Commissioner, Precinct #3
Hon. Norberto Garza	County Commissioner, Precinct #4

COUNTY OFFICIALS

Doroteo Garza	County Auditor
Mario Gonzalez-Davis	County Project Coordinator
Carlos Trevino, Jr.	Director, Zapata County Waterworks
Dioni Hernandez	Project Clerk

TEXAS WATER DEVELOPMENT BOARD

Gilbert Ward, P.E.	TWDB Planning Grants Manager

URBAN PLANNING CONSULTANT

Carlos Colina-Vargas, AICP & Associates

Carlos Colina-Vargas, AICP	Urban Planner
D. Austin Colina	Planning Technician
Connie West Colina	Copy Editor/Secretary
Vivi Colina	Planning Assistant

ENGINEERING CONSULTANT

Garcia & Wright Consulting Engineers, Inc.

Raul H. Garcia, P.E.	Lead Engineer
Wayne Nance, P.E.	Project Engineer

EXECUTIVE SUMMARY

The primary objective of this Flood Protection Planning Study is to provide the information and guidance necessary for Zapata County to make appropriate decisions to prevent and mitigate the effects of storm runoff and flooding. The study area includes the largest urbanized area of the county, where concentration of residents is most dense, and the areas where flooding problems have occurred and are anticipated to recur. That planning area encompasses the unincorporated community of Zapata, a townsite created to serve displaced residents whose communities became permanently immersed when the Rio Grande River was dammed to create Falcon Reservoir. The waters of the reservoir inundated the original community of Zapata and several other communities that also had existed since the 1700s. The present community of Zapata was platted by the U.S. Corps of Engineers on a sloping terrain drained by several arroyos that are tributaries of the Rio Grande River and that now feed Falcon reservoir.

This report contains recommendations for mitigation and elimination of the damage and threat of flooding, including estimated costs of needed improvements, and a flood prevention plan phased to facilitate programming and financing. The overall cost of improvements recommended for the arroyos is estimated to be $8,791,212. Phase One consists of improvements for Arroyo Indio and Arroyo Valeriano, at an estimated cost of $4,753,763. Phase Two consists of improvements for Arroyo Torcido and Arroyo Costa Rica, at an estimated cost of $4,037,449. These figures are preliminary and are based on current costs of such improvements; the county must re-examine the estimates and update them wherever necessary, at the time of construction design immediately prior to implementation. It is recommended that Zapata County take full advantage of the protection and assistance afforded by the National Flood Insurance Program (NFIP) to protect private and public properties from damages and losses caused by flooding, and that the requirements of the NFIP for new development be comprehensively enforced.

ACKNOWLEDGEMENTS

Muchas gracias, distinguidos amigos del Condado Zapata, por la oportunidad de preparar este estudio de planificacion para la proteccion de inundacion.

We wish to express our thanks to the many individuals who contributed to the preparation and successful completion of this planning study. Those individuals have provided encouragement, and have supported the initiative of the application and the work involved in the development of this project. The Zapata County Commissioners Court offered support and understanding throughout the study. Particular recognition is due Commissioner Norberto Salinas, who proposed and initiated the effort to conduct this project and who provided personal support, unselfishly contributing essential input for this project.

The technical portion of the study was prepared by Raul H. Garcia, P.E., a highly respected engineer with a long, productive working relationship the county, which has allowed him to earn invaluable experience and to garner three decades' worth of knowledge of Zapata County.

We extend our profound gratitude to the Zapata County Commissioners, and also to the people of Zapata, for giving us the opportunity to conduct this project in your community. We are humbled and touched by the *gentileza, apoyo, y camaraderia* we always have received in Zapata County. We truly treasure our relationship with Zapata County. Our firm has been assisting the county since 1981. Throughout those years, we have been fortunate to meet and work with numerous memorable residents and some of the finest elected officials and public servants anywhere in the great State of Texas.

To the Flood Protection Planning Fund program of the Texas Water Development Board, and particularly to Mr. Gilbert Ward, P.E., Planning Contract Manager, we extend grateful acknowledgement of their guidance and patience during the planning period.

Muchas gracias a todos.

Su amigo,

Carlos Colina-Vargas, AICP

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PART II

I. LAND USE AND HOUSING STUDY

INTRODUCTION

The preparation of this Flood Protection Planning Study has been made possible through assistance from the Texas Water Development Board. The Texas Water Development Board awarded Zapata County a grant for the purpose of financing a study that included an inventory of existing flood problems and conditions, analysis of needs, development of standards and flood protection criteria, and possible solutions. The Texas Water Development Board makes funds available for projects to promote the prevention of flood damage and the threats to life and property that are posed by uncontrolled runoff.

The fact that the affected areas are largely developed for residential use and populated by low income residents presents significant difficulties in addressing and resolving flooding problems. The general planning area covers four separate identified watersheds comprising most of the urbanized area of the community of Zapata. The most damaging flooding occurs in the Medina Addition portion of the watershed of the Arroyo Indio, which lies in proximity to the school campus and to residences where flooding has inundated many homes and damaged private property. The other watersheds experience lesser flooding problems, but present the potential for severe conditions due to current growth and uncontrolled development.

At present, there are no incorporated communities in Zapata County. The largest community, Zapata, has a population of approximately 9,000 but has no land use controls or zoning that could contribute to the management of land development. Before the recent adoption of model subdivision rules, there were no subdivision standards of any kind in the county.

The county's participation in the National Flood Insurance Program (NFIP), a condition for this planning study, was also recently approved. As a result, all flood prevention responsibilities, countywide, now are under the single jurisdiction of Zapata County.

The county applied for a Flood Protection Planning grant that was approved in May of 2003. The grant of $75,000 was to be matched with $25,000 of local funds. Shortly after the award of the grant, the county entered into an agreement with the firm of Carlos Colina-Vargas, AICP and Associates, Urban Planning and Management Consultants, to prepare the planning study. The firm entered into association with Garcia & Wright

Consulting Engineers, Inc., a firm that long has provided engineering services for Zapata County, and enlisted that firm's services for the technical and engineering support for the project.

GOALS AND OBJECTIVES OF THE STUDY

Zapata County initiated the effort to examine local flooding conditions and to seek possible solutions in response to requests from numerous residents who were affected and to concerns expressed by the County Commissioner from the precinct where the most severe flooding has occurred. The main goal of the study was proposed as the preparation of a plan to determine the extent of flood threat and the formulation of a flood protection strategy. The initial proposal included the following tasks.

1. Data Collection and Area Surveys
2. Land Use and Housing Conditions
3. Hydrologic Analysis
4. Hydraulic Analysis
5. Flood Prevention and Flood Control Alternatives
6. Financial and Economic Analysis
7. Sources of Funding and Assistance
8. Flood Prevention Master Plan
9. Public Participation

This list of tasks became the outline for the TWDB proposal for assistance and, eventually, the scope of the study.

Task 1, Data Collection, includes gathering basic area information, socioeconomic data and general environmental data from sources such as the Natural Resources Information Service (NRIS), the U.S. Geological Survey (USGS), the U.S. Army Corps of Engineers (USCOE), the International Boundary and Water Commission (IBWC), the Federal Emergency Management Agency (FEMA), Zapata County, and local officials.

Task 2, Land Use and Housing, consists of an inventory of current land uses and housing in the identified study area, conducted for the purpose of determining the extent of the flood threat on the area's institutions, residential areas, and public and private properties. The various uses of each parcel of land were surveyed and mapped to create a "snapshot" that illustrates the severity of the potential flood.

Task 3, Hydrologic Analysis, includes the delineation of watershed boundaries and basins and data of each stream flow.

Task 4, Hydraulic Analysis, includes the preparation of models of selected stream locations, from available topographic data, for the purpose of determining the extent of flood and necessary storm improvements.

Task 5, Flood Prevention and Flood Control Alternatives, includes a review of possible solutions to the flooding, and examination of alternative structural solutions, locations, and non-structural solutions.

Task 6, Financial and Economic Analysis, includes the preparation of capital cost estimates for the various locations recommended and the current costs of implementation.

Task 7, Sources of Funding and Assistance , includes a review of available sources of funding for implementation of the proposed improvements.

Task 8, Flood Prevention Master Plan, includes the preparation of a report summarizing the study, data, analysis, and recommendations. A draft report was prepared and submitted to the Texas Water Development Board with a final report contingent upon the approval of the draft material submitted.

Task 9, Coordination of Public Participation, consists of conducting public hearings, as required by program guidelines, disseminating information, and responding to any questions or comments raised by the public or interested agencies or groups, concerning issues related to the study.

OVERVIEW OF ZAPATA COUNTY

Zapata County is located in the South Texas Region on the Rio Grande River and the international boundary between the United States and the Republic of Mexico. The county covers approximately 677,180 acres, or 1,058 square miles, with a land area of 996.8 square miles. It is known for ranching, agricultural production, oil and gas business, and tourism. The community of Zapata, the county seat, is an unincorporated locality with a land area of approximately 6.7 square miles; the community lies 47 miles south of Laredo, 180 miles south of San Antonio, and 148 miles southwest of Corpus Christi. Major roads within the county are U.S. 83, the east-west regional route, and S.H. 16, a north-south route. There is no rail service in the county.

Historical Background

The area where Zapata County is located is one of the earliest to be colonized by Spanish settlers. Settlements in the area were initiated in the 1700s by the expedition led by Jose de Escandon, who also founded communities in northern Mexico and in locations along what is the Texas boundary of today. The land was granted to settlers in land grants called *porciones*. These subdivision boundaries still exist, and some of the land remains the property of the descendants of the original land grants. The area saw violent years during the Mexican Wars, the struggle for the independence of Texas, the American Civil War, and the era of border bandits in the early years of the twentieth century.

Zapata County was created in 1858 from portions of Webb County and Starr County, and was named in honor of Colonel Antonio Zapata, a pioneer rancher who was a native of Guerrero, Mexico. Colonel Zapata fought the Mexican government, spurred the movement for Texas' independence, and ultimately was executed by Mexican authorities. The local economy has evolved from the early economy that was based on ranching and farming to the current one based on the service sector, oil and gas businesses, and tourism. The completion of the construction of U.S. 83 and S.H. 16 in the 1930s, and the discovery of oil and gas in the region provided major impetus for economic growth. In the 1950s, the International Boundary and Water Commission built Falcon Reservoir and inundated the Texas communities of Zapata, Lopeno, Ramireno,

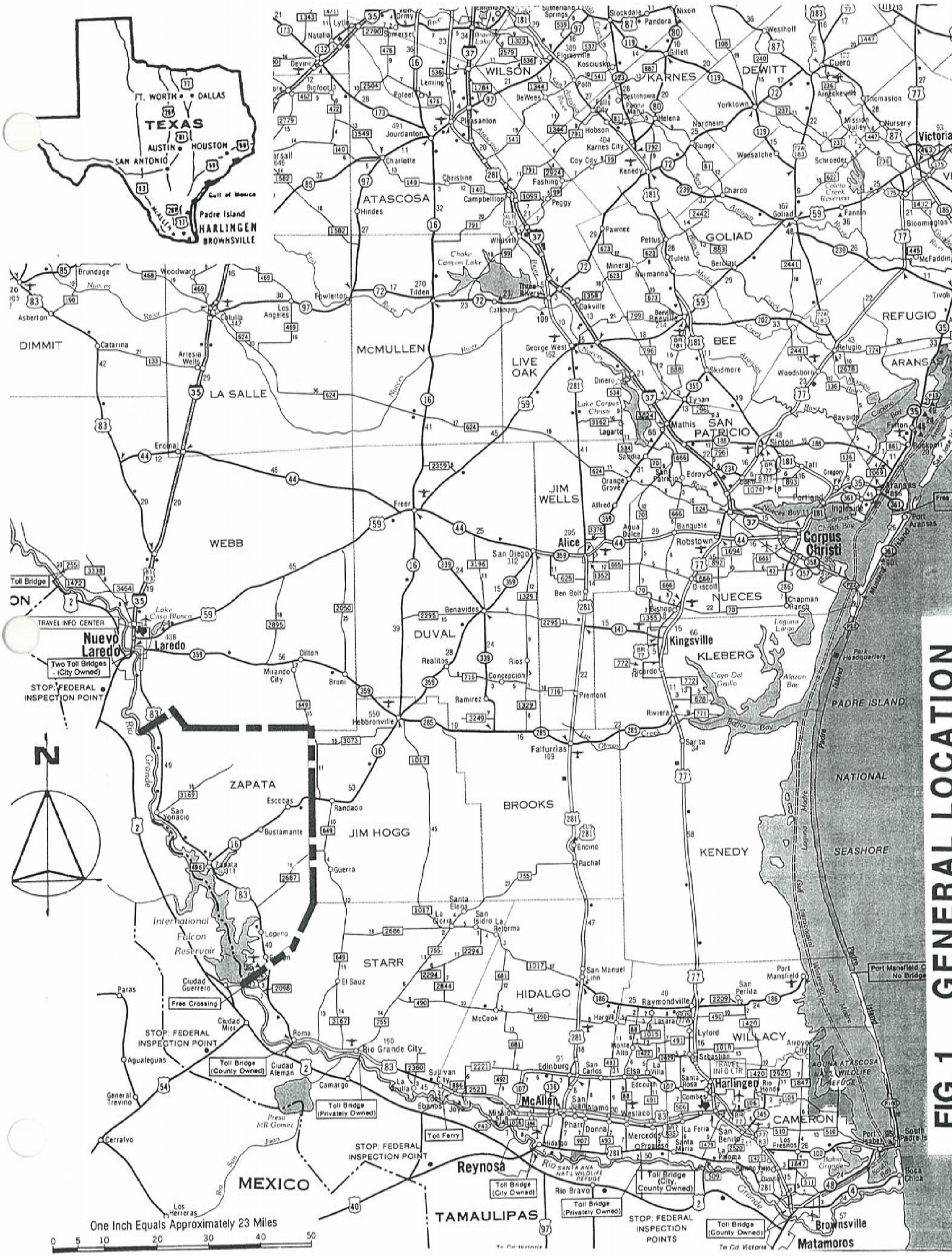


FIG. 1 GENERAL LOCATION

and Uribeno, and caused the development of the present community of Zapata as a place to relocate the displaced populations of those localities. No incorporated cities or cities or towns exist in Zapata County. The majority of the residents of the county live in the community of Zapata, which has a population estimated at approximately 9,000. Other communities include San Ygnacio, which has a population of 850; Lopeno, which has 425 residents; and several smaller communities. Numerous *colonias* dot the immediate area of Zapata and the areas adjacent to Falcon Reservoir.

Population

The population of Zapata County increased significantly in the past three decades. The typical loss of population that occurred in the area in the 1920s and 1930s was arrested with the influx created in the late 1930s with the advent of oil and gas exploration, and the migration into the area that began during the 1950s after the completion of the construction of Falcon Reservoir. The highest rate of growth occurred in the 1970s.

Table 1

Historical Population Figures - Zapata County

Year	% of Change	Population
1930		2,867
1940	+ 36.7%	3,916
1950	+ 12.5%	4,405
1960	- 0.3%	4,393
1970	- 0.9%	4,352
1980	+ 52.3%	6,628
1990	+ 40.0%	9,279
2000	+ 31.2%	12,182

SOURCE : U.S. Census information

The median age of the population in the year 2000 was 30.7 years, which is 4.6 years below the national median age of 35.3 years.

Population Projections

Making projections of population for Zapata County based on historical trends is an inexact effort, since the future population depends on the growth of the region, economic changes, the migration pattern of labor, and the numbers of retirees who may settle in the county. It is evident that the community of Zapata will continue to experience growth and the concentration of businesses.

Table 2
Population Projections - Zapata Townsite

Year:	2010	2015	2020	2025
TWDB-Most Likely[1]	10,722	N/A	15,432	N/A
Consultant's Projection [2]	13,000	15,000	18,000	20,000

Sources: [1] TWDB's Most Likely figures; [2] Planning consultant's projection.

Ethnic and Racial Composition

The U.S. Census for the year 2000 shows a total county population of 12,182; 10,328 residents, or 84.8%, are shown as being of Hispanic ethnicity. This is typical of the localities in this region. The following table shows the reported racial distribution.

Table 3
Race and Hispanic Origin - Zapata County, 2000

Race	Population	% of Total
(Total)	12,182	100.0%
White	10,241	84.1%
Black/African American	50	0.4%
Asian	39	0.3%
Native Hawaiian/Pacific Islander	23	0.2%
Some Other Race	1,540	12.6%
Two or More Races	284	2.3%

Source: U.S. Census of Population, 2000.

Physiography

Zapata County lies adjacent to the Rio Grande River in the South Texas Region. The county encompasses 1,058 square miles of the Rio Grande basin. Physical features are brushy, rolling hills broken by tributaries of the Rio Grande and Falcon Reservoir. Elevations in Zapata County vary from 327 feet to 562 feet MSL.

Land Use

The largest portion of the county (98%) is used for range land. Urban development and irrigated lands are concentrated along the Rio Grande River and U.S. 83 in the northwest sector of the county. An average of only 7,000 to 10,000 acres of cropland are irrigated each year.

Socioeconomic Conditions

With 29.3% of its population living under poverty level, Zapata County is one of the poorest counties in the State of Texas. The following information provides a brief summary of some of the socioeconomic conditions in Zapata County, as reported in the U.S. Census reports for the year 2000.

24.1% of the county's residents are foreign-born, the majority from Mexico.

78.7% speak Spanish.

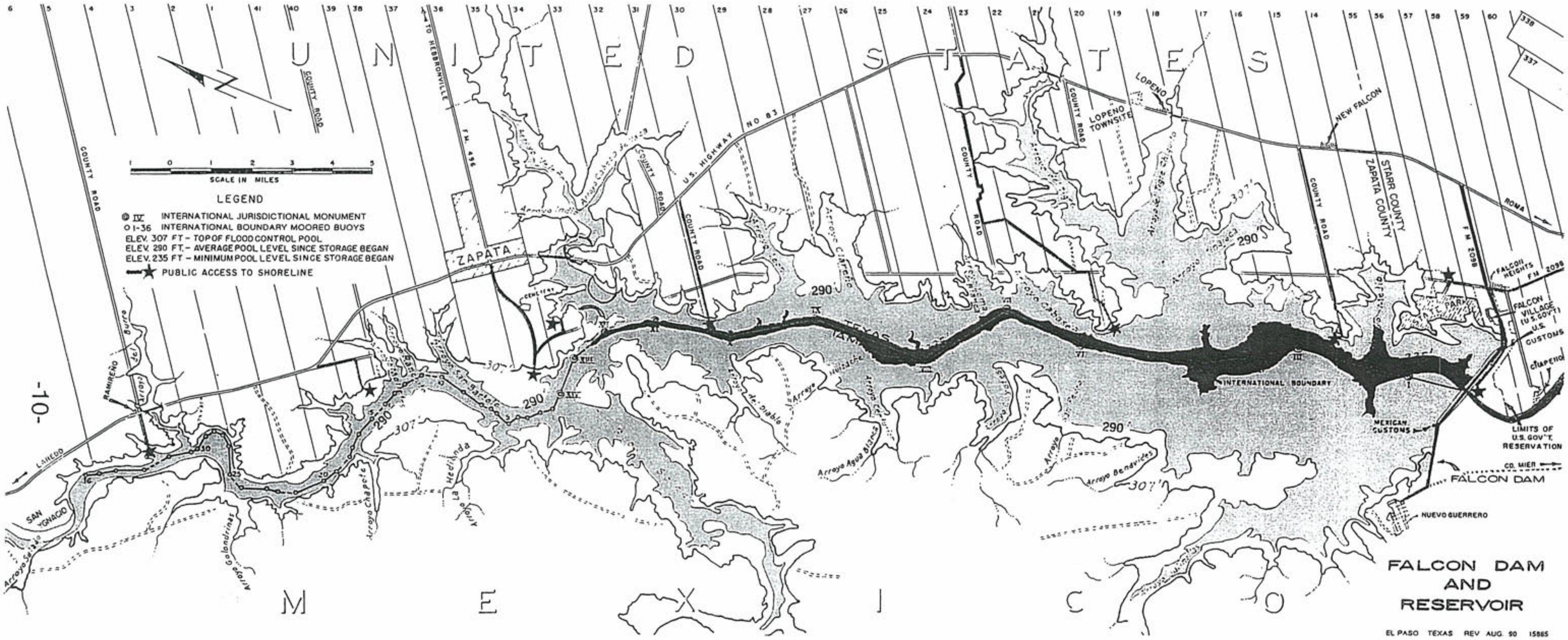
46.9% of residents 25 years of age and older have not finished high school.

The annual per capita income is $10,486.

29.3% of the families live below poverty level.

Owner-occupied housing units have a median value of $46,500.

The average number of persons per household is 3.07 persons.



In the 1950s, Falcon Reservoir impounded waters of the Rio Grande River, the international boundary between the U.S. and Mexico. That action flooded the old communities of Zapata, Lopeno, Ramireno, and Uribeno located on the U.S. side, and the community of Guerrero located on the Mexican side, all of which dated back to the 1700s. The residents of those flooded communities experienced permanent displacement. The target area of this study is located in the present community of Zapata.

FIG. 2 FALCON DAM AND RESERVOIR

LAND USE AND HOUSING STUDY

LAND USE

Introduction

The land use element of this flood protection study is concerned with classification and analysis of the various uses of each parcel of land in the study area. Land use studies provide basic data on land characteristics and uses in the planning area. These data are used to analyze the current pattern of land use and to serve as the basis for determining flood impact and locations at risk of flooding. They provide an essential resource for planning and growth management.

The urban pattern of the community is shaped by various determinants which can be grouped into the following four main categories.

1. Physical. Existing development, environmental characteristics, topography, drainage patterns, soils, etc.

2, Economic. Land value, income generation, development costs, etc.

3, Social. Urban ecology, geographical locations of services, relationships of various community groups, etc.

4, Governmental/Public. The "health, safety, and welfare" interest, legalistic and government activities, land use controls, etc.

The existing land uses of a community reflect the nature and extent of its economic and social activities. The knowledge and analysis of how a community uses its land are important for the evaluation of existing living conditions, and are indispensable when making decisions concerning future land use and the quality of life in a community.

This land use element covers the community of the Zapata townsite, the largest community in Zapata County, which presents urban characteristics and is the location affected by flood occurrence in the study area. Zapata townsite is composed of identified neighborhoods or *barrios* that are referred to locally as "*colonias,*" due to their substandard conditions.

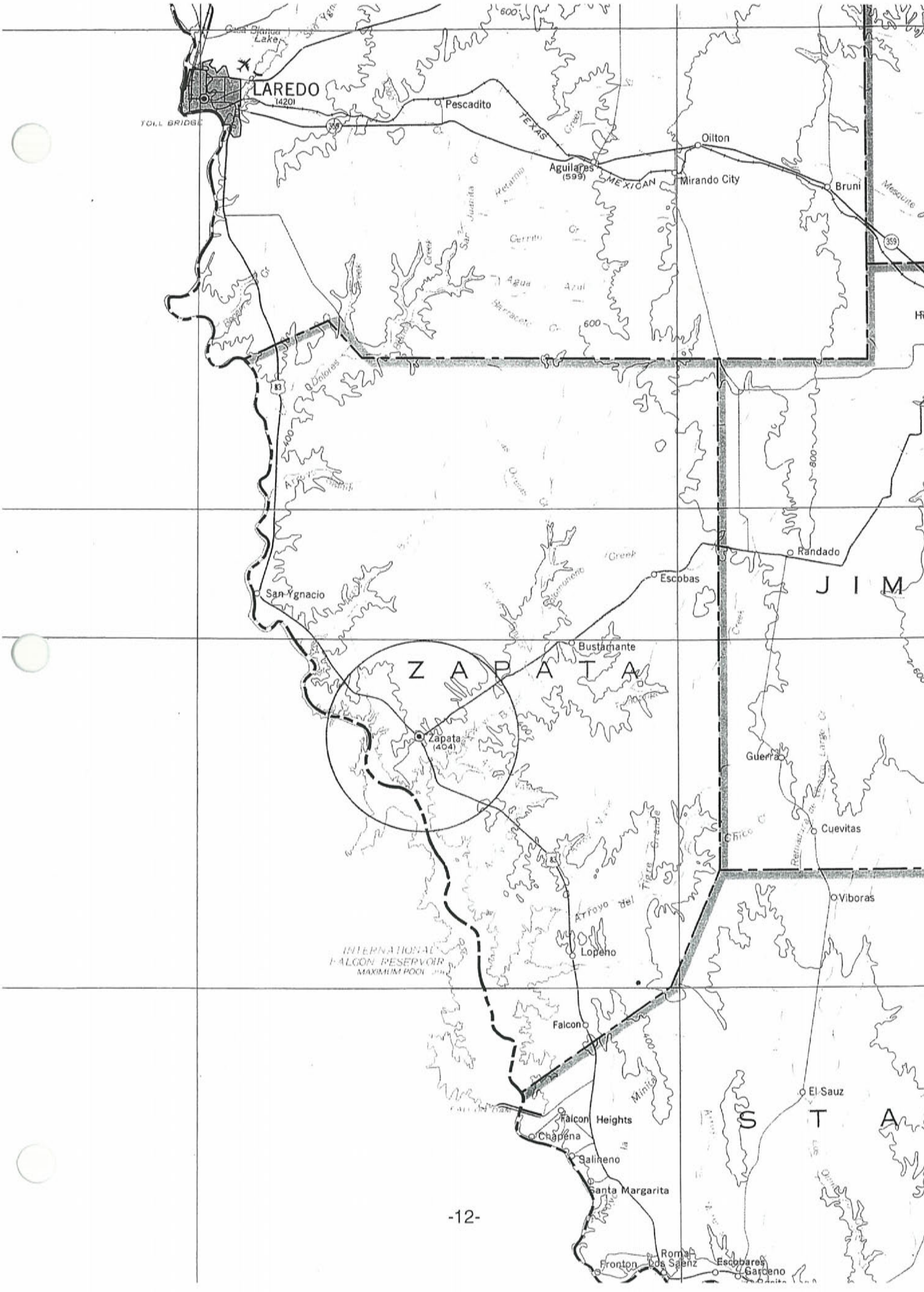


FIG. 3 PROJECT LOCATION - ZAPATA COUNTY

LAND USE INVENTORY

A land use inventory is a basic initial activity in any land use study. The land use inventory identifies the use of each parcel of land in the locality. This information is collected during a field survey that identifies existing locations, resources, and unique conditions that create the land use pattern in the community. The information collected then is tabulated and plotted on area maps that provide the base data for the land use analysis and the future land use plan.

The Zapata townsite community is an urbanized locality that presents many of the land use elements and characteristics typical of small towns. Nevertheless, it is classified as a *colonia* because it remains unincorporated and is experiencing many deficiencies in its infrastructure and housing. After extensive deliberation and consultations with local officials, it was decided that the study would include the entirety of that *colonia* complex, which is composed of the original townsite and the immediately adjacent *colonias* of Medina Addition, Los Flores, Buena Vista, Nickelson/Falcon Shores, and Ranchito San Jose. Although these were platted and developed independent of each other at different times, and each is identifiable as a separate community and meets the criteria established for classification as a *colonia*, these localities are interrelated, forming a complex that shares some common streets and circulation patterns, and that now is served by the same water system and sewer system. The logic of grouping these *colonias* became apparent through the planning of the water system and the sewer system, which revealed the impracticality and, indeed, the impossibility of considering each of these communities as a separate, isolated unit; the entire service system area covering the group of *colonias* had to be treated as a complex for these purposes. The same logic applies to considerations of land use.

The following maps are graphic representations of the findings of the survey of land uses in the *colonias* of the Zapata townsite complex. Table 4 displays the tabulation of the findings, and Table 5 expresses the land uses in a ratio of number of acres per 100 persons, evidencing the low density development pattern of the study area.

Table 4

Land Uses in the Zapata Colonia Complex , 2000

Land Use Category	Area in Acres	Percentage of Total
Residential, Single-family	516.1	43%
Residential, Multi-family	5.0	0.04%
Commercial/Retail	87.4	7%
Industrial/Light Industry	41.6	3%
Public/Semi-public	124.1	10%
Parks/Cemeteries	61.6	5%
Vacant Developed	339.6	28%
Vacant Undeveloped*		
Agricultural	0.0	0%
TOTAL AREA SURVEYED	1,175.4	100%
AREA DEVELOPED	835.8	71.7%
AREA UNDEVELOPED*		

Note: Land use figures on this table do not include streets, rights-of-way, alleys, or roads.

* The "Vacant Undeveloped" category cannot be tabulated because *colonias* have no official boundaries; all platted land within a *colonia* is, by definition, developed.

For purposes of tabulation of the results of the survey, a simplified land use category system was used to reflect the commonly established uses in the community. The United States standard system for identifying and coding land use activities was not used, since there was no attempt to provide nor was there any need to provide detail greater than that presented by the categories used.

A large portion of the urbanized areas that were surveyed remains undeveloped. Development occurring outside of this urbanized area is scattered at best; this development is composed, primarily, of commercial uses located along U.S 83 and the residential uses found in *colonias* distant from Zapata. U.S. 83 exerts influence for new commercial development; however, this development often is related to the regional trade or travelers and therefore, ironically, may be less important to the purpose of serving the community even though it affects the land uses, the traffic, and the overall physical pattern in the area.

The school district's property is the largest institutional land use in the planning area. This is reflected in extraordinarily disproportionate land use figures that may present a somewhat distorted land use image.

Table 5

Land Uses in Acres per 100 Persons - Zapata Colonia Complex, 2000

Land Use Category	Area in Acres	Acres per 100 Persons
Residential, Single-family	516.1	5.16
Residential, Multi-family	5.0	0.05
Commercial/Retail	87.4	0.87
Industrial/Light Industry	41.6	0.41
Public/Semi-public	124.1	1.24
Parks/Cemeteries	61.6	0.61
Vacant Developed	339.6	3.39
Vacant Undeveloped*		
Agricultural	0.0	0.00
TOTAL AREA SURVEYED	1,175.0	100.00

NOTE: Land use figures on this table do not include streets, rights-of-way, alleys, or roads. The "Acres per 100 Persons" ratio is used for comparison purposes to determine density of uses among comparable communities. These figures also are used to estimate future land use demands by land use category, based on population projections. The "Acres per 100 Persons" data, applied to the population, result in estimates of Future Land Use Demands.

* The "Vacant Undeveloped" category cannot be tabulated because *colonias* have no official boundaries; all platted land within a *colonia* is, by definition, developed.

HOUSING

Occupied Dwelling Units

The field survey showed 4,419 housing units in the study area, which were assumed to be permanent units. No major new residential development is being considered at this time, but a great deal of speculation occurs concerning new subdivision developments, particularly in areas adjacent to Falcon Reservoir. The location of this community, in the proximity of Falcon Reservoir and the Lower Rio Grande Valley, offers opportunities for residential development for retirees who prefer a small-town type of residential environment, and it is likely that private developers will meet these market demands in due time. The location also may be attractive to industrial developments seeking to serve international trade and the region's markets, and this, may result in the creation of demands for nearby housing for those moving into the area to work in the new industrial developments.

Existing and Anticipated Population

Zapata County has experienced steady growth in the last several years, after a boom in population during the 1980s, a decade that was characterized by an increase in population in many communities in the region. The 1990 U.S. Census reported a population of 9,279; the 2000 population figure is 12,182. It is estimated that 10,000 people reside in the Zapata townsite *colonia* complex. By the year 2010, the population can be expected to increase to 13,000. The present area can accommodate all required land uses for the anticipated population of the year 2010 if the current low density pattern continues unchanged, and if the population experiences no extraordinary increase due to external influences. The location of future developments will depend largely on individual developers' activities and the availability of utilities to the sites being considered. Significant surges in population may occur if several developments are carried out. The largest of these would be (a) development of motels and other facilities for travelers, and additional commercial uses along U.S. 83; (b) construction of the alternative U.S. 83 route and improvements on S.H. 16; and (c) continued increases in the NAFTA trade. Several subdivisions are platted but either are not yet developed or have seen only very minor development. Also, and important consideration is the proximity of the nearby developed *colonias* for which Zapata County will be providing water service and sewer service.

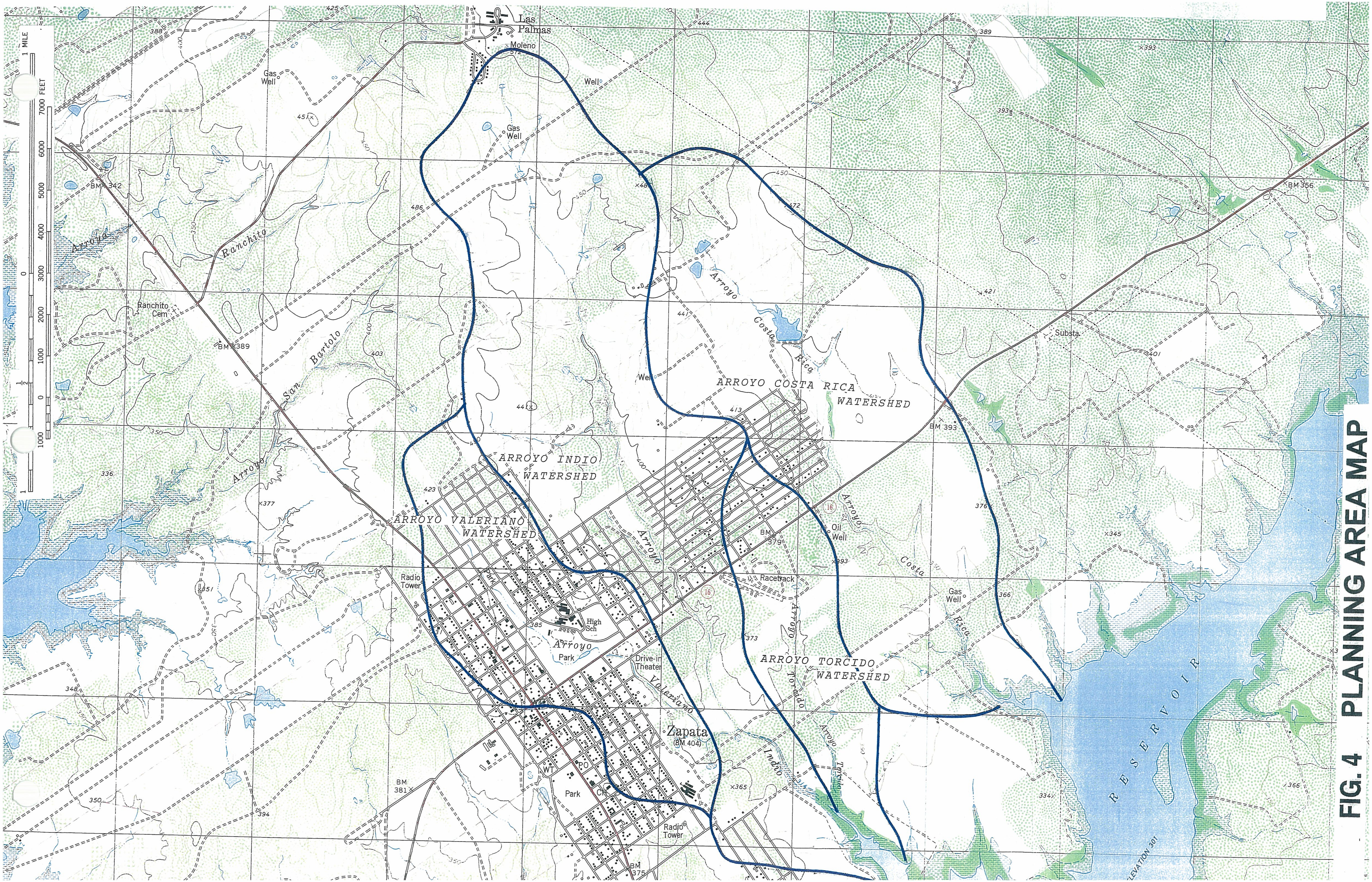


FIG. 4 PLANNING AREA MAP

Physical Characteristics of the Land – Soil Characteristics

Important determinants of the land use in any locality are the physical properties of the land, including soil composition and physiographic characteristics. These physical conditions affect the pattern of urbanization of a community and the actual configuration of physical development.

Soil types determine the suitability of a site for construction of buildings or installation of sewer system facilities, and the drainage conditions; therefore, to some extent, they limit the types of land uses possible or practical for any given area. Soils of Zapata County include the following groups.

Zapata-Maverick Soils: level to moderately sloping, very shallow to deep, fine to medium textured soils. These soils cover approximately 16% of the county.

Copita-Brennan Soils: level to gently sloping, deep, fine to medium textured, moderately permeable soils. These soils cover approximately 14% of the county.

Copita-Zapata Soils: level to moderately sloping, deep to very shallow, fine to medium textured, moderately permeable soils. These soils cover approximately 16% of the county.

Delmita-Zapata Soils: level to moderately sloping, deep to very shallow, medium textured, moderately permeable soils. These soils cover approximately 6% of the county.

Nueces-Comitas Soils: level to moderately sloping, deep, coarse textured, moderately to rapidly permeable soils. These soils cover approximately 16% of the county.

Maverick-Caterina Soils: shallow, saline, level to moderately sloping, deep to shallow, fine textured, slowly permeable soils. These soils cover approximately 37% of the county.

Storm Drainage Problem Areas

The combination of the topography of the terrain and the lack of adequate drainage facilities causes serious drainage problems throughout a part of the urbanized area. The land slopes gently toward Falcon Reservoir, and concentrates storm runoff in the Arroyo Indio, which transverses the locality at the Medina Addition, and the Arroyo Valeriano, which transverses Zapata County Park #1 and the local school campus. Zapata is located in hilly terrain not conducive to ponding. However, ponding does occur on some lots and streets, imposing inconvenience and threatening to create health problems, during extended rainy periods. It is anticipated that a systematic drainage improvement effort, guided by appropriate engineering, can mitigate these problems.

Topography

Zapata is located at an elevation between 327 and 562 feet MSL, within a large area that slopes toward Falcon Reservoir. Natural drainage flows southward, toward the reservoir. The drainage pattern is created by area depressions and several arroyos. The Arroyo Indio flows through the Medina Addition and is of major concern due to the fact that it flows through the middle of Zapata County Park #1 and continues on, through the school campus, functioning as a drainageway for a large neighborhood but causing no flooding damage because its entire basin is open space. The area slopes gently southward, for the most part. Low areas are prone to flooding, and ponding occurs throughout San Ygnacio, which is crossed by an *arroyo* that impacts the physical layout of the neighborhoods but is necessary for drainage.

Vegetation

An important determinant in planning, local vegetation has been gently altered in the region, due to agricultural uses and land development. Vegetation in the geographical region varies in response to altitude and soil texture in its natural state; however, this is changed to accommodate crops and cultivation. Most local vegetation consists of domestic plant materials, and little remains of the indigenous vegetation of mesquite, acacias, and grasses that once covered the area. Most of the natural brush vegetation occurs along the arroyos and in shallow places in Falcon Reservoir.

Climate

Zapata County lies in the eastern extent of a semi-arid region and has an average annual rainfall of 19.7 inches. Summer thunderstorms are common, and the annual rainfall varies greatly; the resulting unpredictability precludes attempts at non-irrigated farming in this area. Local temperatures range from the January mean minimum of 43 degrees Fahrenheit to the July mean maximum of 99 degrees Fahrenheit. Negative impact of the climate can be ameliorated by design: both design of the community, which stresses wide streets and generous use of vegetation, and design of individual buildings that can be oriented to take advantage of the southeasterly prevailing winds

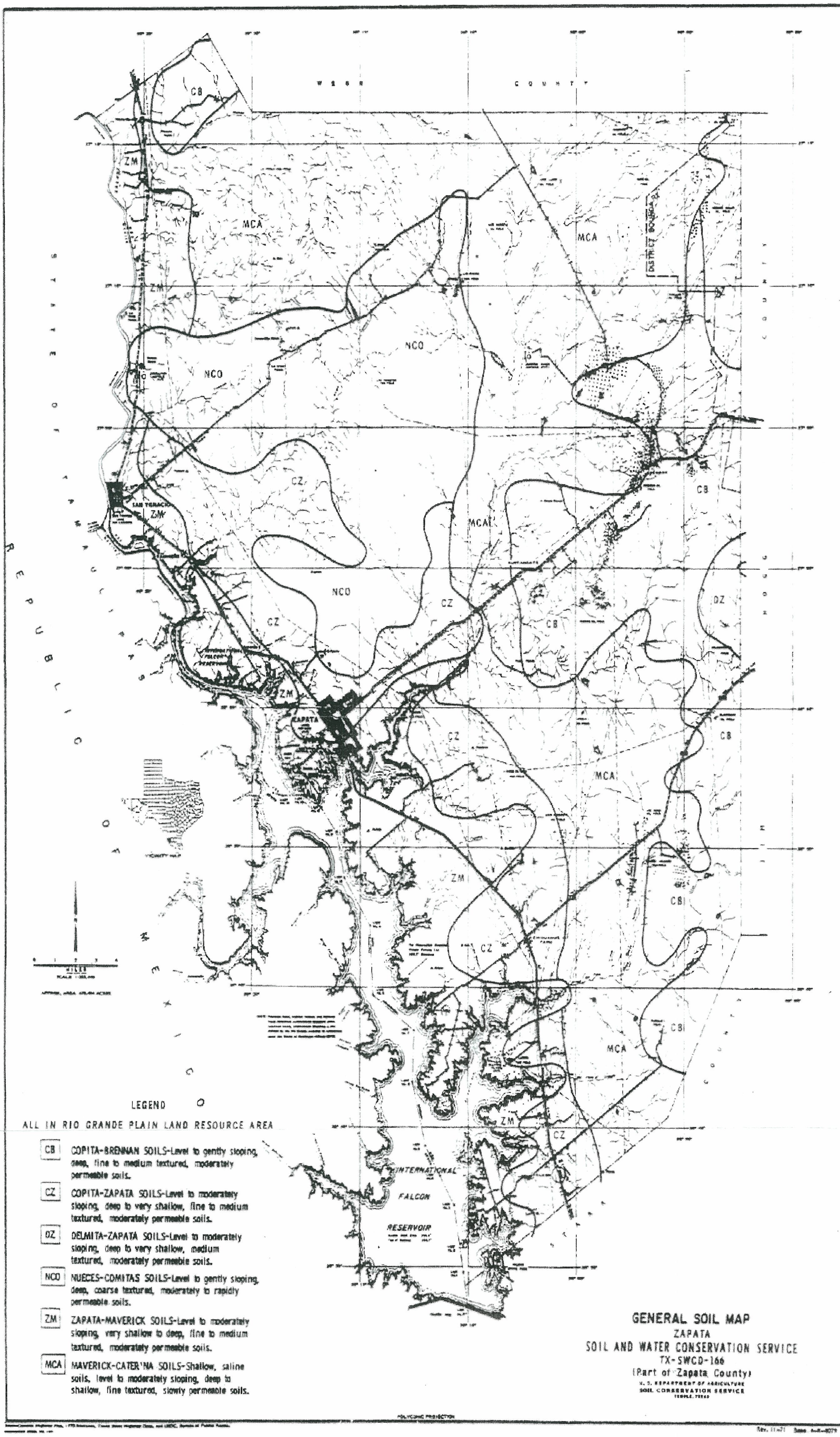


FIG. 5 SOIL MAP

and aided by landscaping. High winds occur during thunderstorms and tropical storms, but tornadoes are rare in Zapata County.

Rainfall is the major contributor to flooding in the area; annual rainfall varies widely and, in the recent past, the lack of adequate rain has caused serious detrimental effects on the agriculture and tourism sectors locally, and on the general economy of the area. The following list displays a ten-year sequence from the rainfall record maintained by the International Boundary and Water Commission.

Year	Rate
1997	19.6
1998	14.2
1999	21.0
2000	11.6
2001	17.3
2002	20.7
2003	34.4
2004	30.7
2005	17.6
2006	22.4

Land Use Pattern in Zapata

The future land use pattern will remain similar to the existing land use pattern. U.S. 83 and S.H. 16 will continue to be the major area thoroughfares dictating the growth structure of the community, with the proposed U.S. 83 alternative route being the major influence for new growth. Additional land uses will occur as extensions of the existing areas. It also can be anticipated that a certain amount of growth will continue to occur outside of the present *colonia* complex in the area adjacent to Falcon Reservoir and beyond. This is unfortunate because it presents special problems pertaining to utility extensions, future improvements, and building standards. The continuing development will increase runoff in the area immediately affected. Even though the watershed and basin of the arroyos will not change, the effects of uncontrolled runoff will increase, along with the threats to life and property.

HOUSING CHARACTERISTICS

Information concerning housing was deemed important to the efforts to determine the potential effects of flooding and the cost/benefit analysis for the required improvements. Gathering accurate, reliable housing information required field observation, housing counts, and review of data from the Texas Water Development Board as well as a previous study funded by the Economically Distressed Areas Program. For other issues, U.S. Census information also was used. The following table summarizes the findings.

Table 6

Housing Units - Planning Area

Location	No. of Units	Estimated Population
Medina Addition	1,020	2,736
Zapata Townsite	1,041	2,712
Ranchito San Jose	29	45
San Jose Village	25	69
Cuellar Addition 2	32	54
Flores Addition	95	267
Falcon Shores	169	417
Buena Vista	105	297
TOTAL AREA	**2,516**	**6,597**

Housing Conditions

Housing conditions vary throughout the planning area, with a prevalent number of units in deteriorating conditions. It has been reported that 66.7% of all units can be categorized as deteriorating, and 6.4% as dilapidated beyond repair or unfit for habitation. The vacant units observed are not a major concern, since vacancy rates change periodically.

Poor housing dots the area, reflecting the low income of residents and the initial substandard construction of some units; nevertheless, there is no single area that is characterized by a concentration of such units that could be classified as a slum.

Housing Values

A previous study reported the mean value of housing units in the county as $35,500 in 1994. The U.S. Census for the year 200 reports the median value as $46.500; however, today the cost of replacement is estimated at $60,000.

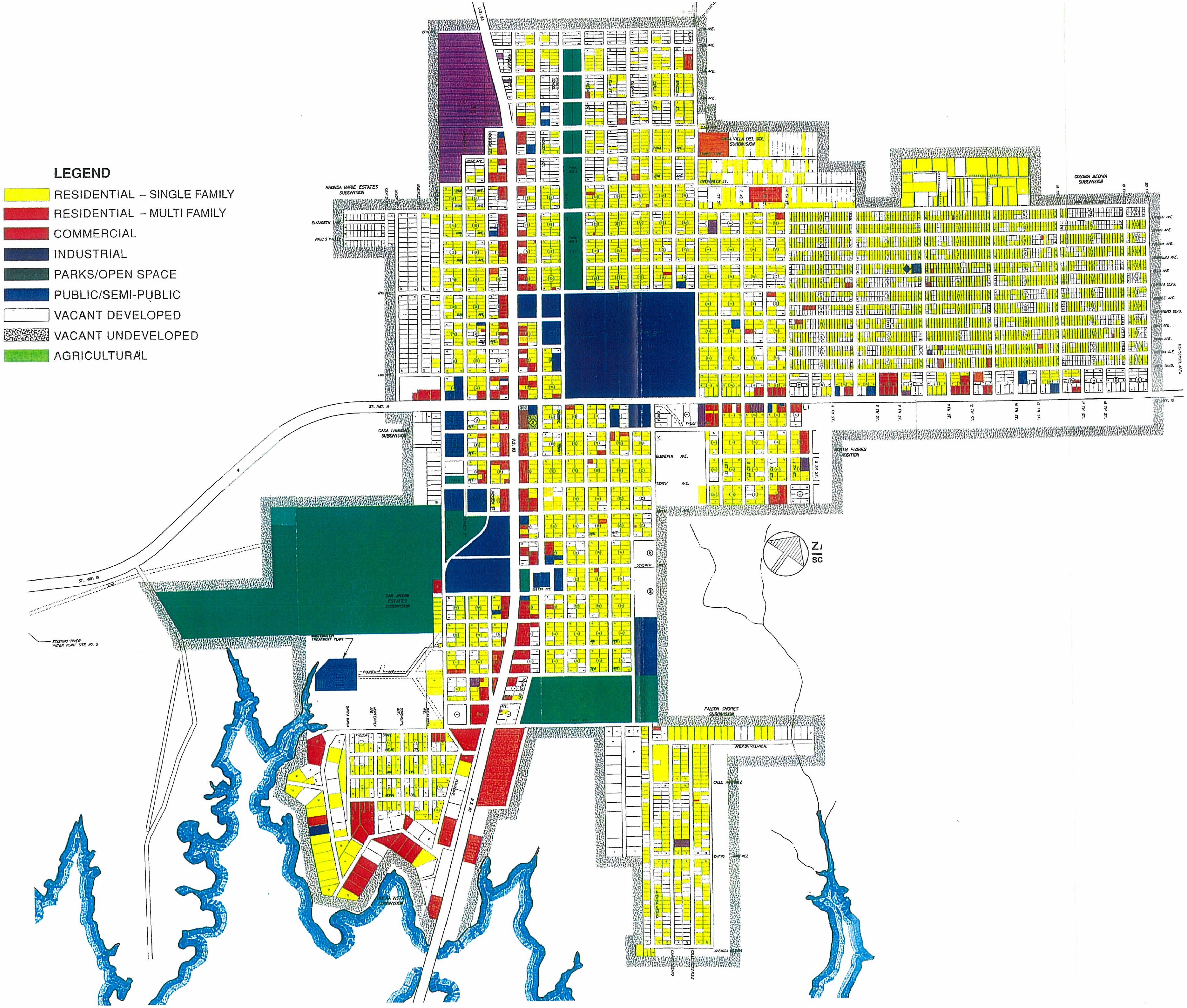


FIG. 6 LAND USE MAP

II. HYDROLOGY STUDY

INTRODUCTION

Carlos Colina-Vargas & Associates contracted with Garcia & Wright Consulting Engineers, Inc. (G&W) to perform an engineering floodplain analysis on all major arroyos within the Zapata Townsite (Arroyos Valeriano, Indio, Torcido and Costa Rica) for Zapata County and the Texas Water Development Board (See Figure 7 – Project Location Map). This study includes hydrology, floodplain hydraulic analysis (using HEC-RAS software), recommendations with cost estimates, floodplain mapping, and the following comprehensive report summarizing our findings, conclusions, and recommendations.

HYDROLOGY

Before the extents of a floodplain can be hydraulically evaluated, historical rainfall data must be reviewed to determine the amount of runoff associated with a particular, recurrent rainfall event. Floodplain boundaries are generally defined based on the runoff calculated for the 100-year rainfall storm event (1% probability per year). Other common events are the 2, 5, 10, 25, and 50-year events, which correspond to a 50%, 20%, 10%, 4%, and 2% probability per year, respectively. For clarity and since typical urban drainage designs are determined from the 25-year event with a 100-year analysis, only the 25 & 100 year storms were evaluated in this study.

There are a number of hydrologic methods that can be used to establish runoff discharges for a particular recurrent storm. The most common are the following:

- Rational Equation
- National Resource Conservation Commission (NRCS) TR-55
- Regional Regression Equations
- US Army Corps of Engineers' HEC 1 Software

Each method has a particular set of conditions under which it is more accurate, or preferred than other methods. The rational equation is the most basic method, but it is only applicable to relatively small drainage areas, generally under 200 acres in size. NRCS Technical Release 55 (TR-55) is used for larger watersheds that have times of concentration (runoff travel times) under 10 hours. Regional regression equations are numerically derived from empirical data gather from area stream gauges and can be used on medium to large drainage areas. These equations were recently updated and published through the Texas Department of Transportation (TxDOT) in *Regional Equations for Estimation of Peak-Streamflow Frequency for Natural Basins in Texas, US Geological Survey Water-Resource Investigations Report 96-4307* by Asquith and Slade. HEC-1 software is applicable for most areas, but is typically reserved for hydrologic analysis on larger, more complicated drainage basins.

The watershed boundaries for the four arroyos (dry creeks) that traverse the greater Zapata Townsite are shown in Figure 8 with background USGS topographic contour maps. Each drainage basin generally drains to the southeast and empties into the Falcon Reservoir. Vegetation in undeveloped areas consists primarily of desert shrub and brush; the soils are generally sandy loams. Figure 9 shows the drainage area boundaries, subareas with names and sizes, and corresponding Points of Concentration (PC) at which runoff discharges are calculated. Information from this figure has been reduced and listed in Table 6. The last two columns of this table list the discharges calculated at each PC for the 25 and 100-year storm events.

The discharges listed in Table 6 were calculated from both the rational method and regional regression equations. The rational method was used for subareas in the basin headwater under 200 acres in size (PC-1, 9, 10, 12, and 13), which are listed in detail in Table 7. The rational equation's upper area limit coincides with the regression equation's lower area limit of 0.36 square miles (230 acres). The regression equations were used to calculate the discharges at the remaining PCs listed in Table 6. The components of these two equations are summarized below:

Rational Equation

Q = CIA, where

Q = Discharge in cubic feet per second (cfs)
C = Runoff Coefficient
I = Calculated peak rainfall intensity in inches per hour (in/hr)
From TxDOT/National Weather Bureau Formula, $I=b/(tc+d)^e$
A = Contributing drainage area in acres

Regional Regression Equations (Region 6)

$$\mathbf{Q_{25} = 3290A^{.392}SL^{-.428}}$$
$$\mathbf{Q_{100} = 1780A^{.440}}$$ where

Q = Discharge in cubic feet per second (cfs)
A = Contributing drainage area in square miles (mi^2)
SL=Stream Slope in feet per mile (ft/mi)

As listed in Table 7, the rational equation results in a larger 25-year discharge at PC-1 and PC-10 than the regression equation at the corresponding downstream PC-2 and PC-11, which is illogical. Therefore, PC-1 and PC-10 have been modified to be equal to the downstream value calculated using regression equations at these points.

Runoff calculations using the NRCS TR-55 Method were planned for a final comparison with the values calculated with the described methods above. However, the discharges calculated from this method depend significantly on the Curve Numbers (CN-values) determined from detailed county soils maps.

Unfortunately, the local NRCS office informed G&W that detailed soils maps for Zapata County were not currently available. The only soil map that they had was a general soil map, as shown in Figure 5.

For comparative purposes only, CN values were roughly estimated based on the general soil map (Figure 10) and discharge values were calculated using the NRCS TR-55 Method at the four concentration points along SH-16, namely PC-2, 6, 10, and 14. Detailed breakdowns of the TR-55 worksheet calculations are provided in the Appendix. Table 8 summarizes the calculated discharge at these points using both TR-55 and regression methods. As shown, TR-55 results in substantially higher 25-year runoff rates and slightly higher 100-year storm discharges. However, until detailed soils maps are available for Zapata County the TR-55 results cannot be used with justifiable confidence.

The regional regression equations for this part of Texas (Region 6) are based on empirical data collected from 21 stream gauges in the South Texas area. They provide the best available method of calculating runoff in the area, except for the areas below 200 acres that are evaluated with the rational method. Therefore, the runoff discharge values listed in Table 6 will be used to develop the hydraulic analysis discussed in the remainder of this report.

HYDRAULIC ANALYSIS

The runoff discharges described above are used together with existing channel geometric data, culvert dimensions, and other physical properties of the floodplain as input in developing a hydraulic model of the areas in question. The channel topography was determined from 7 ½ minute USGS topographic maps (Zapata & Arroyo Veleno). More detailed contour maps were requested from the US International Boundary and Water Commission (USIBWC) and TNRIS, but none were available. The dimensions and elevations of the four culverts and/or bridges under SH-16 were taken from record engineering drawings provided by TxDOT and from field measurements gathered during site visits. Hydraulic characteristics of the channels, such as conveyance values were determined from site visits. A Major Drainage Facilities Inventory is shown in Figure 11.

These parameters were input into the U.S. Army Corps of Engineers, Hydraulic Engineering Center, River Analysis System (HEC-RAS) software and run to determine water surface elevations and other hydraulic characteristics of the flood waters during the 25 and 100-year storm events. The cross-section locations where geometric data were taken for model input are numbered and shown in Figure 12. Results of the existing 100-year water surface elevations calculated by the software are summarized in the Existing Flood Zone Boundary Map shown in Figure 13. Isometric views of the flood zones are provided in Figures 14 through 16. Stream Profiles are shown in Figures 17 through 20.

Standard calibration analysis were not performed because there is no known data of any events to confirm the finding of this study.

As shown in Figure 13, all four creeks have flood zones that encroach upon commercial and residential lots. A number of homes and businesses are currently located within the existing flood zone. The County of Zapata has purchased a number of lots within the flood zone to control development in these areas, but there are several lots that remain privately owned and/or inhabited.

As shown in the stream profiles (Figure 17 through Figure 20), and Hydraulic Output Tables (Table 9 through Table 12):

1. The existing multi-Box culvert (MBC) at Arroyo Indio (Figure 18) under State Highway 16 has sufficient capacity to convey the 100-year storm without overtopping the roadway.

2. Arroyo Costa Rica (Figure 20) had an overflow depth of less than 2 inches during the 100 year event.

3. The 3-7'x7' MBC along Arroyo Valeriano (Figure 17) would experience roadway overflow of approximately 4" deep.

4. The existing 2-42" reinforced concrete pipe (RCP) culvert under SH-16 along Arroyo Torcido (Figure 19) is substantially undersized and experiences over 12" of roadway overflow during a 100-year event, which is a potential traffic hazard.

As shown in the stream profiles (Figure 17 through Figure 20), the existing multi-Box culverts (MBC) at Arroyo Indio under State Highway 16 has sufficient capacity to convey the 100-year storm without overtopping the roadway. Arroyo Costa Rica had an overflow depth of less then 2 inches during the 100 year event. The hydraulic model indicated that the 3-7'x7' MBC along Arroyo Valeriano would experience roadway overflow of approximately 4" deep. However, the model indicates that the existing 2-42" reinforced concrete pipe (RCP) culvert under SH-16 in the Torcido watershed is substantially undersized and experiences over 12" of roadway overflow during a 100-year event, which is a potential traffic hazard.

It is important to note that the results calculated with HEC-RAS and listed in this report are limited by the accuracy of the input data, particularly the USGS 10-foot elevation contour maps used in the cross sections. Field survey of the drainage areas in question would be required to establish the exact horizontal and vertical locations of the 100-year floodplain. However, the general extents of the flood prone areas identified in the report and recommended solutions that follow remain applicable without this level of position accuracy.

FLOOD PREVENTION AND FLOOD CONTROL ALTERNATIVES

There are a number of drainage improvements that can be constructed to better contain the flood waters in those areas that encroach upon private property within the township and are otherwise hazardous to its citizens:

Arroyo Valeriano

As shown in Figure 21, a storm sewer system consisting of curb inlets and pipe sewers is proposed along G-Street to contain the 25-year storm event in the Valeriano watershed. This system will also provide a significant reduction to the water surface elevations of the 100-year event in this developed commercial area. These improvements will be located within existing roadway right of way. The streets in the construction area will need to be fully reconstructed to allow proper drainage toward the proposed inlets.

Arroyo Indio

The proposed improvements in the Indio watershed are shown in Figure 21 and include the construction of a new concrete lined channel from Mira Flores Avenue to Highway 16 with concrete culvert bridges on alternating streets to accommodate traffic across the arroyo during rain events. A concrete lined (riprap) channel was selected in lieu of an earthen channel since existing sandy soils are subject to erosion. Concrete channels also minimize the tree and brush growth within the channel section, which inhibits flow and raises flood zone levels. Concrete lined channels are also more hydraulically efficient than earthen channels, which allows for substantially reduced ditch sizes and a corresponding reduction in land acquisition requirements.

The proposed 3-6'x4' MBCs shown are designed to convey the 25-year storm without roadway overflow. The 100-year storm will overtop the streets, but will be maintained within the proposed ditch section. Culverts were located on alternating streets to save cost, but the County may determine a different layout to meet their needs. Existing roadways that intersect the proposed ditch without a proposed culvert must be closed by barricades and/or the construction of cul-de-sacs to prohibit traffic from driving into the channel.

Arroyo Torcido

Figure 21 shows the proposed storm sewer system with curb inlets, pipe sewers, box sewer, and a riprap channel planned along 13th Street to intercept the 25-year storm event in the Torcido watershed. This system will also lower the 100-year flood levels substantially. These improvements will be located within existing roadway right of way, except for the riprap channel. The streets in the construction area will need to be fully reconstructed to allow proper drainage toward the proposed inlets. These improvements should be coordinated with

TxDOT, who may choose to upgrade the existing culvert under SH-16 to adequately convey a design storm without roadway overflow.

Arroyo Costa Rica

The proposed improvements in the Costa Rica watershed are shown in Figure 21, which include the construction of a new concrete lined channel from Mira Flores Avenue to Medina Avenue with concrete culvert bridges on every third street to accommodate traffic across the arroyo during rain events. A concrete lined (riprap) channel was selected in lieu of an earthen channel for the same reasons described above in the Arroyo Indio section.

The proposed 2-6'x4' MBCs and 3-6'x4' MBCs shown are designed to convey the 25-year storm without roadway overflow. The 100-year storm will overtop the streets over these culverts, but will be maintained within the proposed ditch section. Culverts were located on alternating streets to save cost, but the County may determine a different layout to meet their needs. Existing roadways that intersect the proposed ditch without a proposed culvert must be closed by barricades and/or the construction of cul-de-sacs to prohibit traffic from driving into the channel.

ESTIMATED COST

An itemized breakdown of the estimated project costs associated with each of the improvement areas described above are listed in Tables 13 through 16. The improvements in the Arroyo Valeriano area are estimated to be approximately $1.4 Million. The improvements in the Arroyo Indio, Torcido, and Costa Rica areas are estimated roughly $3.3 million, $1.7 million, and $2.3 million, respectively. The total estimated cost of the combined projects is approximately $8.7 million, as shown in Table 17.

BENEFIT / COST ANALYSIS

The flood protection study recommends improvements that mitigate problems and contribute to elimination of threats to public safety and welfare. The cost effectiveness of the project may be determined by a comparison of the cost of the improvements with the replacement cost of the property, both public and private, that is protected from damage; however, there are other costs, both tangible and intangible, that are associated with floods and that are difficult or impossible to assess accurately. Those costs include: costs of disruption of traffic on S.H.16, a major access road into Zapata, and its effect on commerce; costs of disruption to families; costs of temporary relocation; and costs of damage to infrastructure. Following is a schedule of anticipated damages and costs for the four arroyos studied.

Item	Cost
1. Residential units (40)	$1,000,000
2. Personal property (40 households)	800,000
3. Public infrastructure (roads, water & sewer, power)	1,000,000
4. Miscellaneous property (fences, patios)	500,000
5. Business impact, commercial/retail, and tourism (2 days)	500,000
6. School impact (attendance, traffic – 2 days)	100,000
TOTAL	$3,900,000

The amount of $3,900,000 is the anticipated cost associated with a single severe occurrence. Since Zapata County very recently became eligible for FEMA insurance, it is impossible to determine accurately how much would be covered. It should not be considered unreasonable to anticipate five occurrences during a thirty-year life of the facilities, given the history of flooding that has been experienced in these arroyos. This represents a long-term cost of $19,500,000 in damage impact, which must be compared to the estimated total capital improvements cost of $8,791,212 for all of the arroyo improvements.

SOURCES OF FUNDING AND ASSISTANCE

Outside sources of funding for capital improvements and planning studies, currently available to local government entities, include grants and loans from agencies of the state government and the federal government. Information regarding assistance available to border communities has been complied from several sources including the state and federal agencies. Information on these programs changes or is modified periodically. The following list summarizes information related to selected sources of funding for capital improvements projects.

1. **Office of Rural Community Affairs**
   P. O. Box 12877
   Austin, TX 78711

   Texas Community Development Block Grant Program – Community Development Fund

   Regional, competitive 100% grants. (Local match, however, is encouraged.)

Amount:	$800,000 maximum, Community Development Fund (or as set by the Regional Review Committee);
	$500,000 maximum, Colonia Construction Fund
Application Cycle:	Annual
Eligible Activities:	All capital improvements except buildings for general local government, such as city halls, jails, and police department buildings.

2. **Rural Development Service** (formerly FmHA)
   U.S. Department of Agriculture
   Room 5344, South Agriculture Building
   14th and Independence Avenue S.W.
   Washington, D.C. 20250

   Community Facilities Loans/Grants Program

   Negotiated low-interest loans and/or partial grants (not to exceed 75% of the total project cost). Application evaluation considers local income and municipal indebtedness.

Amount:	Negotiable
Application Cycle:	No deadline. Requires pre-application through District Director.
Eligible Activities:	Public facilities; all capital improvements.

   Other funding is available from this program, under the following categories:

Business and Industry Guarantee Loans
Business and Industry Direct Loans
Revolving Loan Fund – Intermediary Relending Program Loans
Rural Venture Capital Demonstration Project
Rural Business Opportunity Grants
Rural Business Enterprise Grants
Rural Economic Development Loans and Grants
Technical Assistance and financing for water and wastewater systems
Community Facilities

"306" Colonia Water and Wastewater Loans and Grants

Assistance for basic water and sewer system improvements in *colonia*-eligible locations.

3. **Department of Homeland Security**
Federal Emergency Management Agency (FEMA)
500 C Street, SW
Washington, D.C. 20472

Drainage and flood hazard protection funding - FEMA Assistance

Grants and loans for the cost of improvements, from revolving loan funds capitalized by state bonds. (Also available are matching grants under FEMA.)

Amount:	Negotiable
Application Cycle:	No deadline.
Eligible Activities:	Water system, sewer system, drainage improvements.

4. **Economic Development Administration, Regional Office**
U.S. Department of Commerce
305 Congress Avenue
Austin, TX 78701

Public Works and Development Facilities Program

Assistance on a matching grant basis, for 50% to 80% of the total costs of projects, for the development of capital improvements that are essential to support business and industrial development. (Commitment from private entities must exist before applying.)

Amount:	Negotiable
Application Cycle:	Annual issuance; notification by EDA.
Eligible Activities:	Public works/infrastructure projects

5. **Texas Department of Transportation**
125 East 11th Street
Austin, TX 78701

Highway Construction Fund

Financing for the cost of drainage improvements serving state highways.

Amount:	$10,000 maximum
Application Cycle:	Annual
Eligible Activities:	Drainage and storm control structures, easement acquisition, and construction

6. **U.S. Corps of Engineers**

Local Flood Damage Reduction Program

Funding available under Section 205 of the 1948 Flood Control Act for essential improvements.

Amount:	Negotiable
Application Cycle:	None
Eligible Activities:	Flood improvements

7. **Texas Water Development Board**
17 N. Congress Avenue
Austin, TX 78711

Flood Control Projects Loan Program

Funding available for low-interest loans for structural and non-structural flood prevention, including acquisition, retention basins, modification or reconstruction of bridges, removal of buildings, relocation, warning systems, erosion control and development of floodplain management plans.

8. **Local Financing**

The following are various approaches available to localities for financing flood control improvements efforts.

A. Tax-based/General Revenue

This approach is practical for small improvements projects. All homeowners contribute via local *ad valorem* taxes.

B. Capital Recovery Fees

This fees program for new development functions best in fast-growing areas.

C. Municipal Drainage Utility Districts

As authorized under state law, a locality can create a taxing district.

D. "Pay-as-you-go"

Under this approach, improvements are financed with existing monies available from General Fund or the Road and Bridge Fund, or are capitalized by short-term loans.

FLOOD PREVENTION MASTER PLAN

The Flood Prevention Study identifies the extent of the flood problem in the planning area and recommends improvements by location under the Flood Prevention and Flood Control Alternatives section. The study also presents cost estimates for the needed improvements, by location.

Implementation of a plan for drainage improvements is based on priorities and decisions of the local governing body, which also considers funding issues, coordination with state and federal agencies, and availability of easements. The cost of all of the needed improvements exceeds the fiscal ability of the county to handle all at once and, therefore, it is necessary to consider carrying out the construction of the projects in phases. Phasing can facilitate and ensure the eventual construction of all of the recommended improvements without compromising the final objective of the effort.

A timeline cannot be determined until a decision is made regarding financing. It is estimated that, after financing for it is arranged and a notice to proceed is issued, each phase would take two years to complete. The implementation plan must be flexible, so that it can be adjusted easily to accommodate changes in circumstances.

PHASE I

Project	Cost	Year
Arroyo Indio	$3,317,940	one
Arroyo Valeriano	1,435,823	one
Subtotal	$4,753,763	(2 yrs)

PHASE II

Project	Cost	Year
Arroyo Torcido	$1,691,565	two
Arroyo Costa Rica	2,345,884	two
Subtotal	$4,037,449	(2 yrs)

Costs shown are preliminary estimates based on the stated recommendations and assumptions at the time of the study. These figures must be revised, upon approval to proceed with implementation, in order to actualize costs with current construction costs and recommendations.

FIGURES

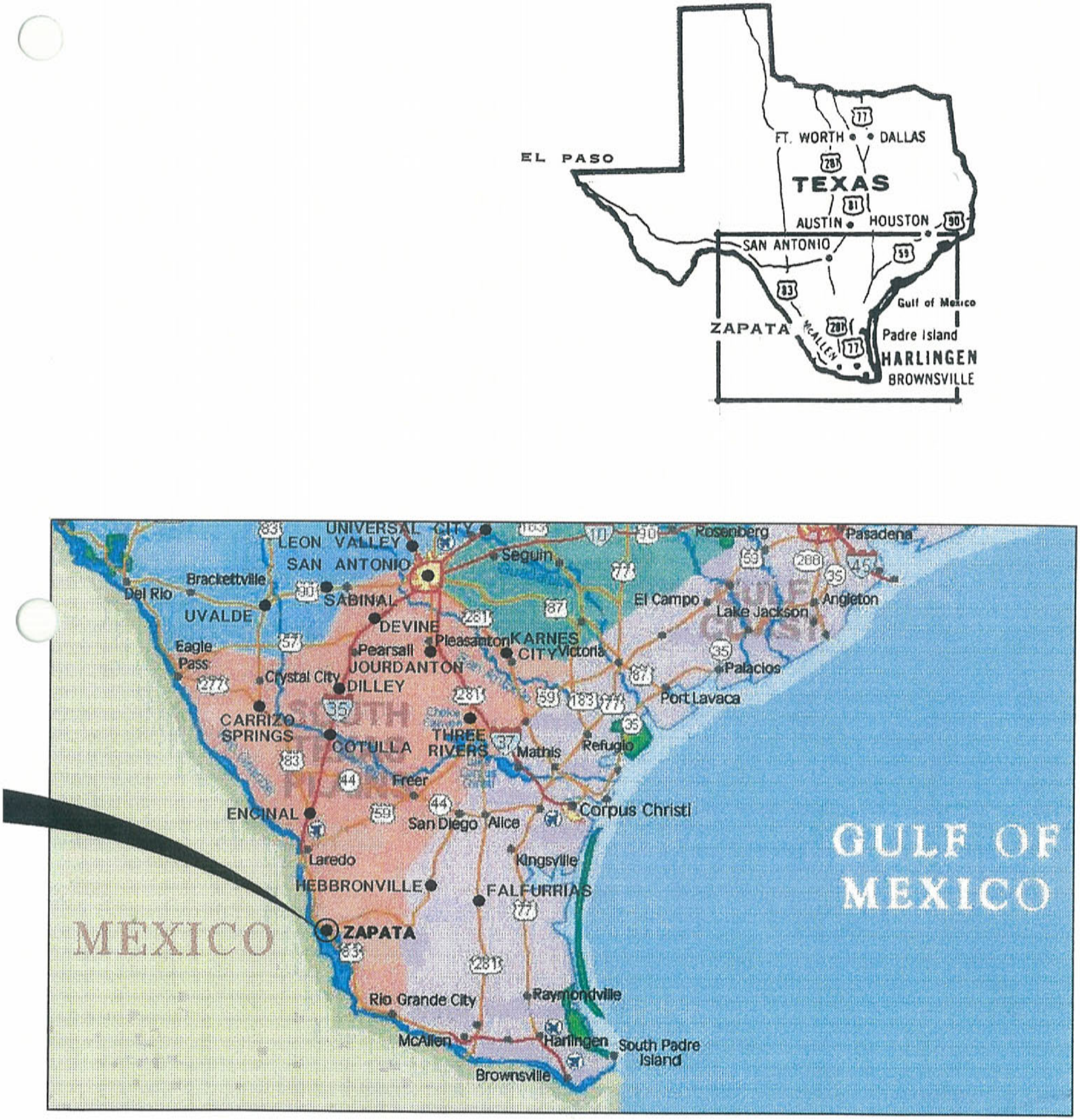


FIG. 7 PROJECT LOCATION MAP

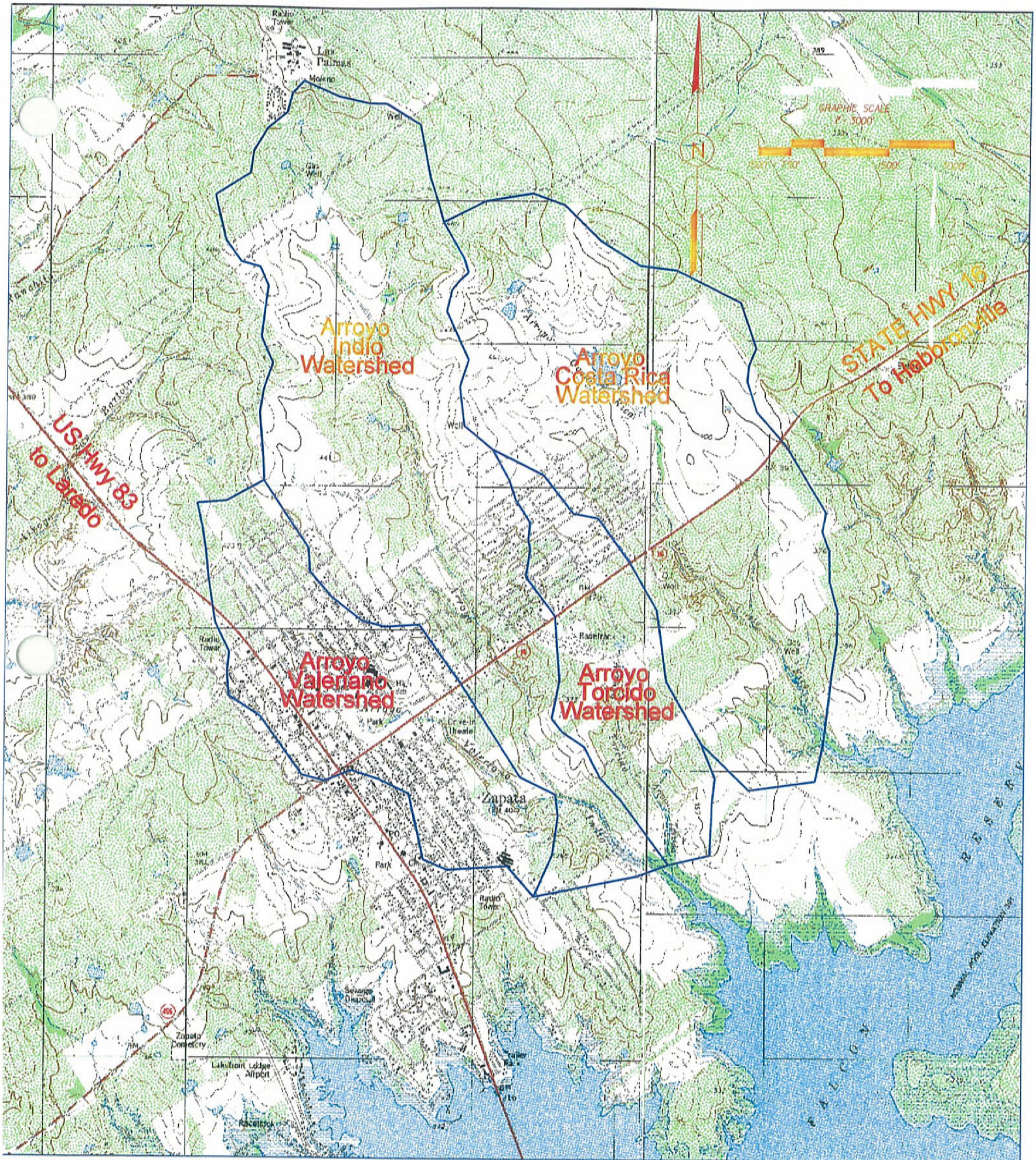
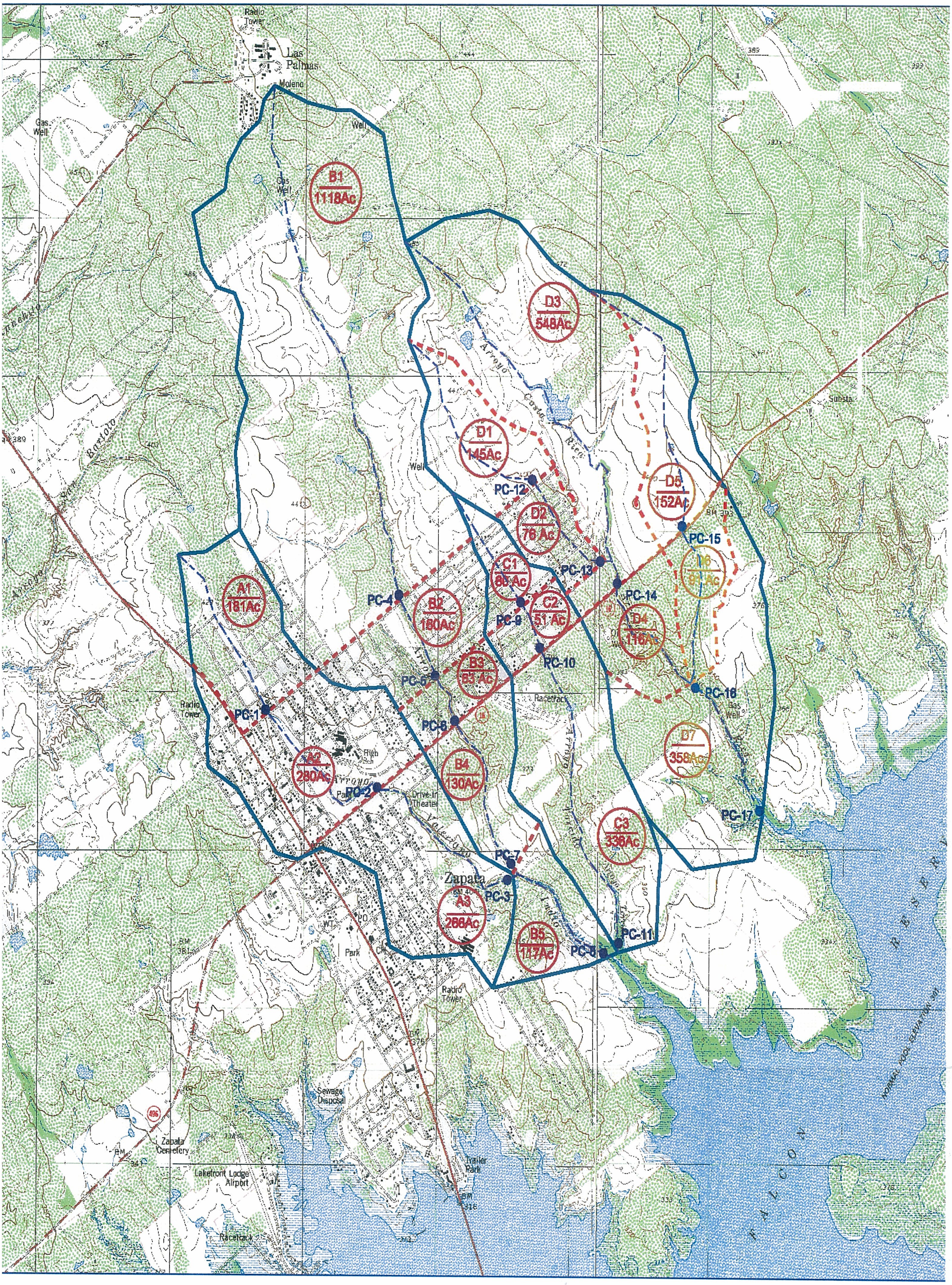


FIG. 8 WATERSHED BOUNDARY MAP

GARCIA & WRIGHT CONSULTING ENGINEERS, INC.



ZAPATA TEXAS

FIG. 9 DRAINAGE AREA MAP

GARCIA & WRIGHT
CONSULTING ENGINEERS, INC.

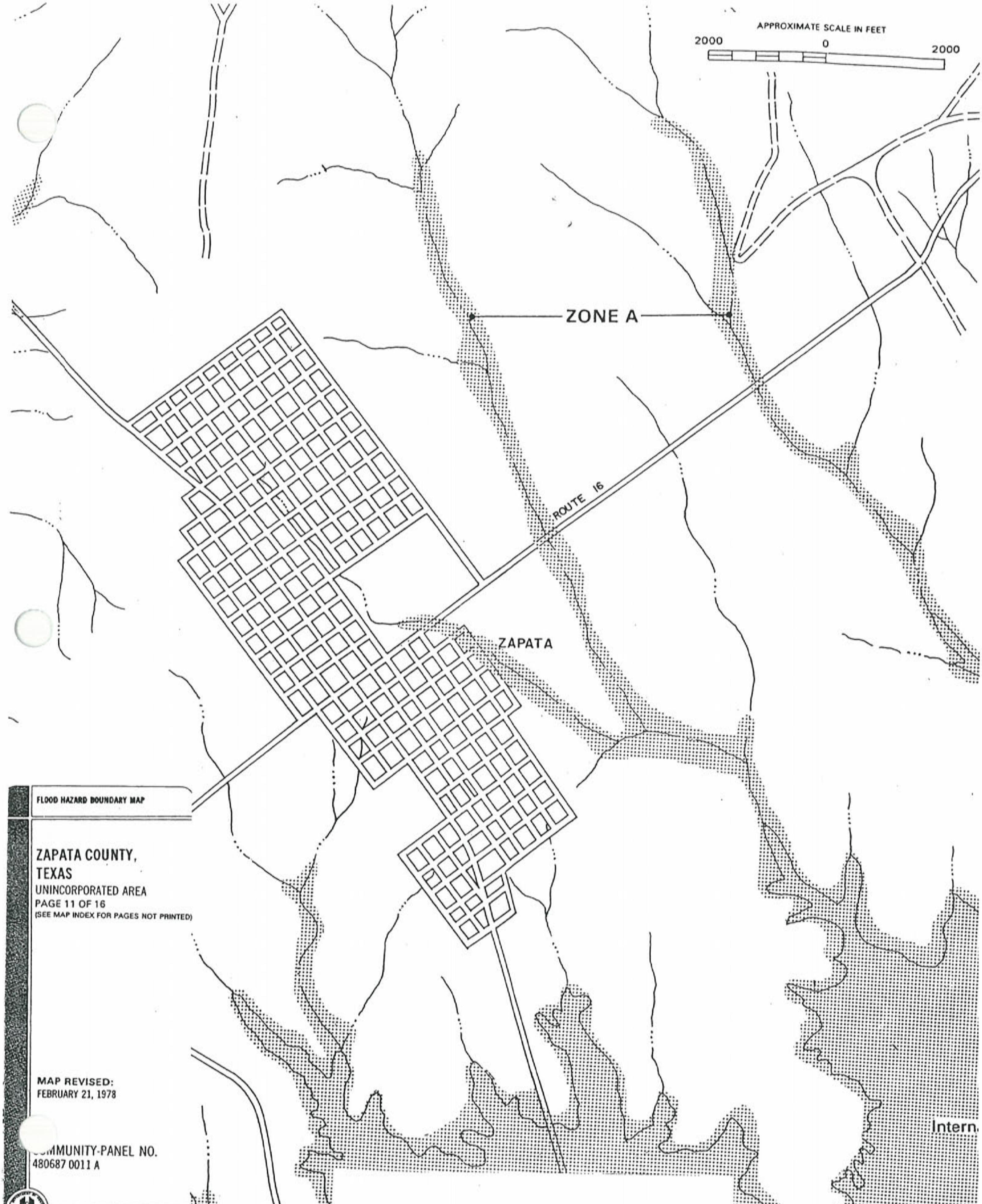


FIG. 10 FEMA/FIRM FLOOD ZONE MAP

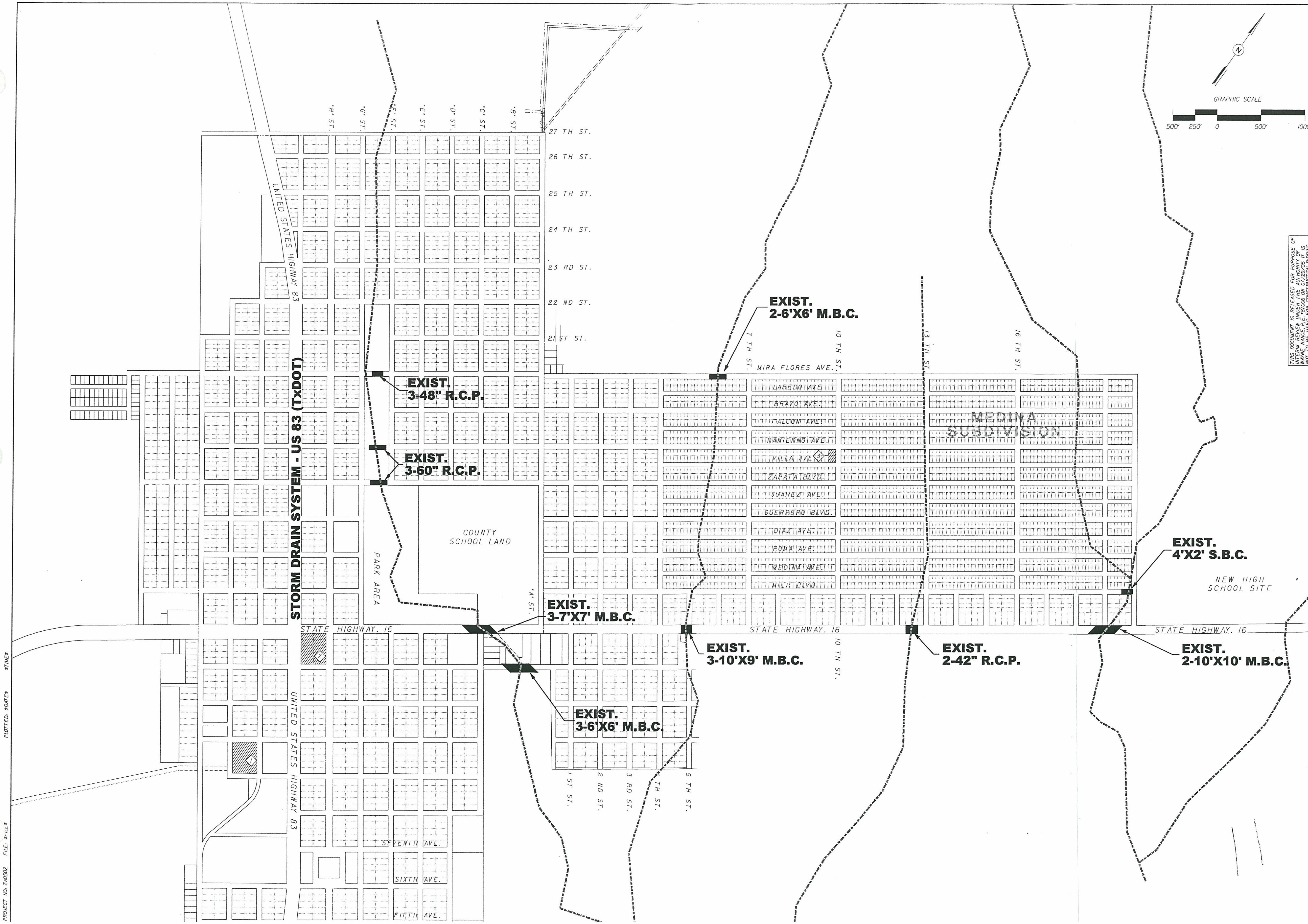


FIG. 11 EXISTING MAJOR DRAINAGE FACILITIES INVENTORY

ZAPATA COUNTY, TEXAS & 2005 FLOOD PLAIN STUDY

GARCIA & WRIGHT CONSULTING ENGINEERS, INC.

DRAWN BY: L.C.R. CHECKED BY: W.N.

NO. DATE REVISIONS BY

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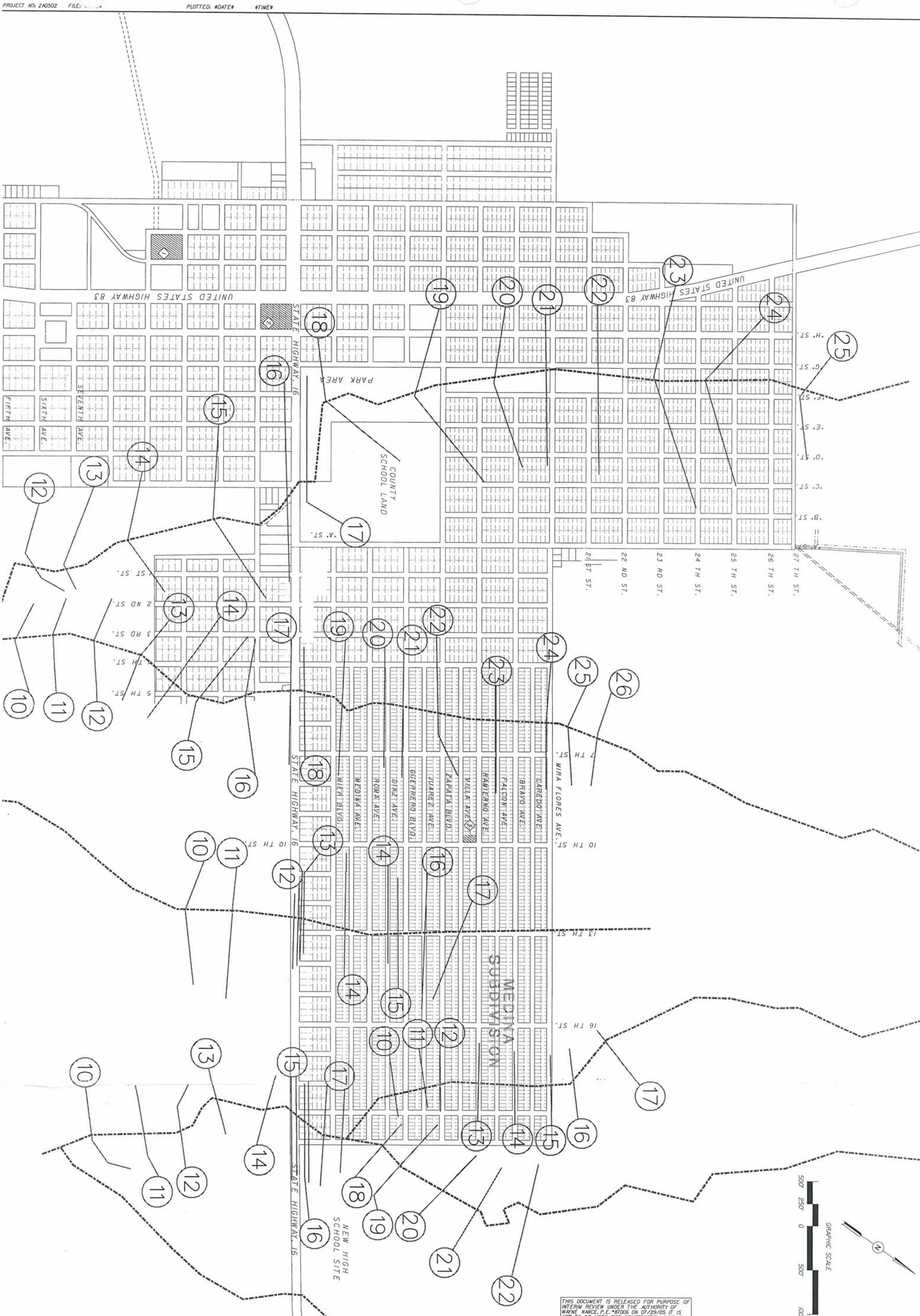


ZAPATA COUNTY, TEXAS
& 2005 FLOOD PLAIN STUDY

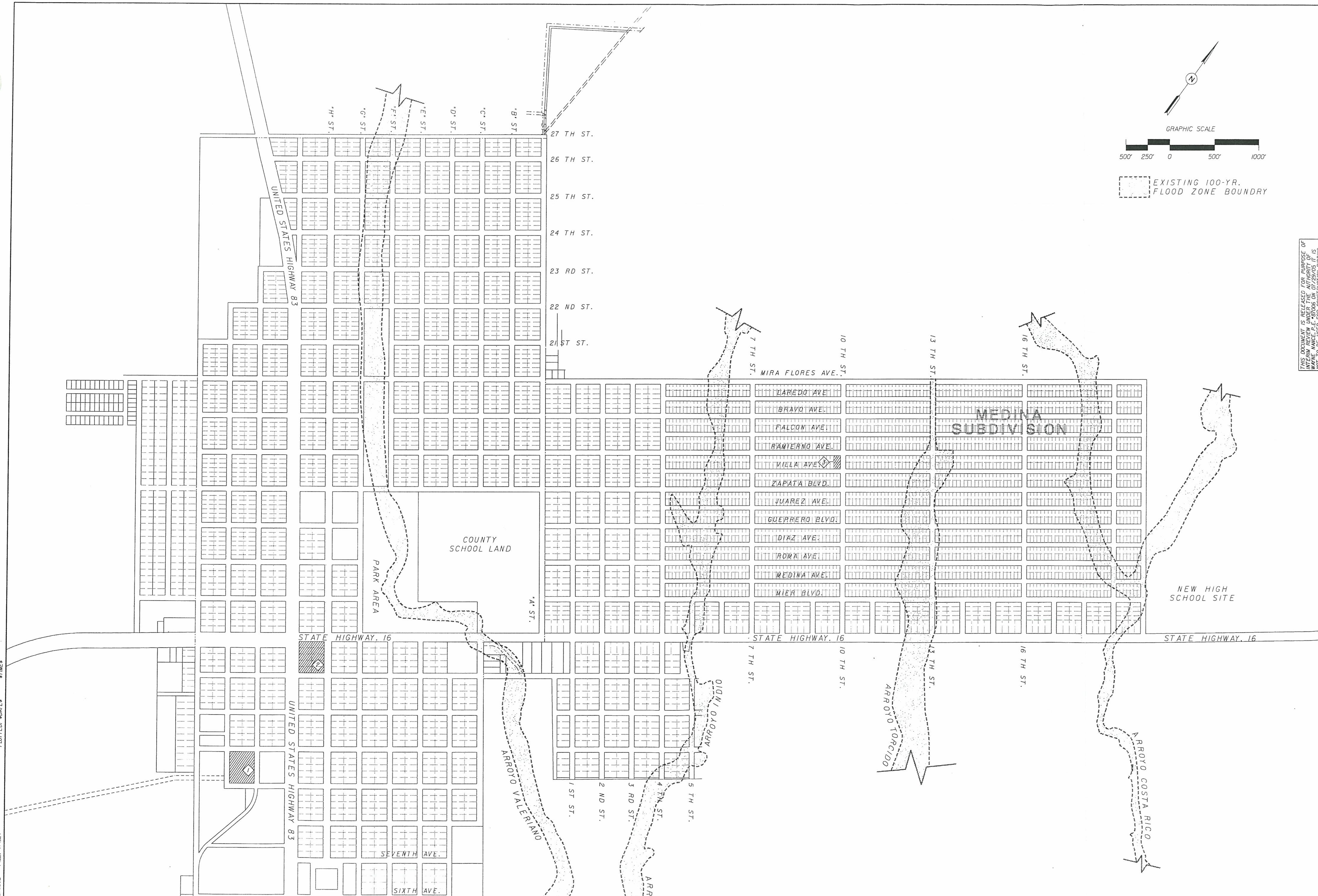
GARCIA & WRIGHT CONSULTING ENGINEERS, INC.

L.C.R.
DRAWN BY:
W.N.
CHECKED BY:

NO.	DATE	REVISIONS	BY

DATE :
REGISTERED PROFESSIONAL ENGINEER

FIG. 12 CROSS SECTION LOCATION MAP



*NOTE: 100 YEAR FLOOD BOUNDRY SHOWN IS BASED ON USGS 7½- MINUTE TOPOGRAPHICAL

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NO.	DATE	REVISIONS	BY

DATE: REGISTERED PROFESSIONAL ENGINEER

L.C.R. DRAWN BY:
W.N. CHECKED BY:

GARCIA & WRIGHT CONSULTING ENGINEERS, INC.

ZAPATA COUNTY, TEXAS
& 2005 FLOOD PLAIN STUDY

FIG. 13 EXISTING FLOOD ZONE BOUNDARY MAP

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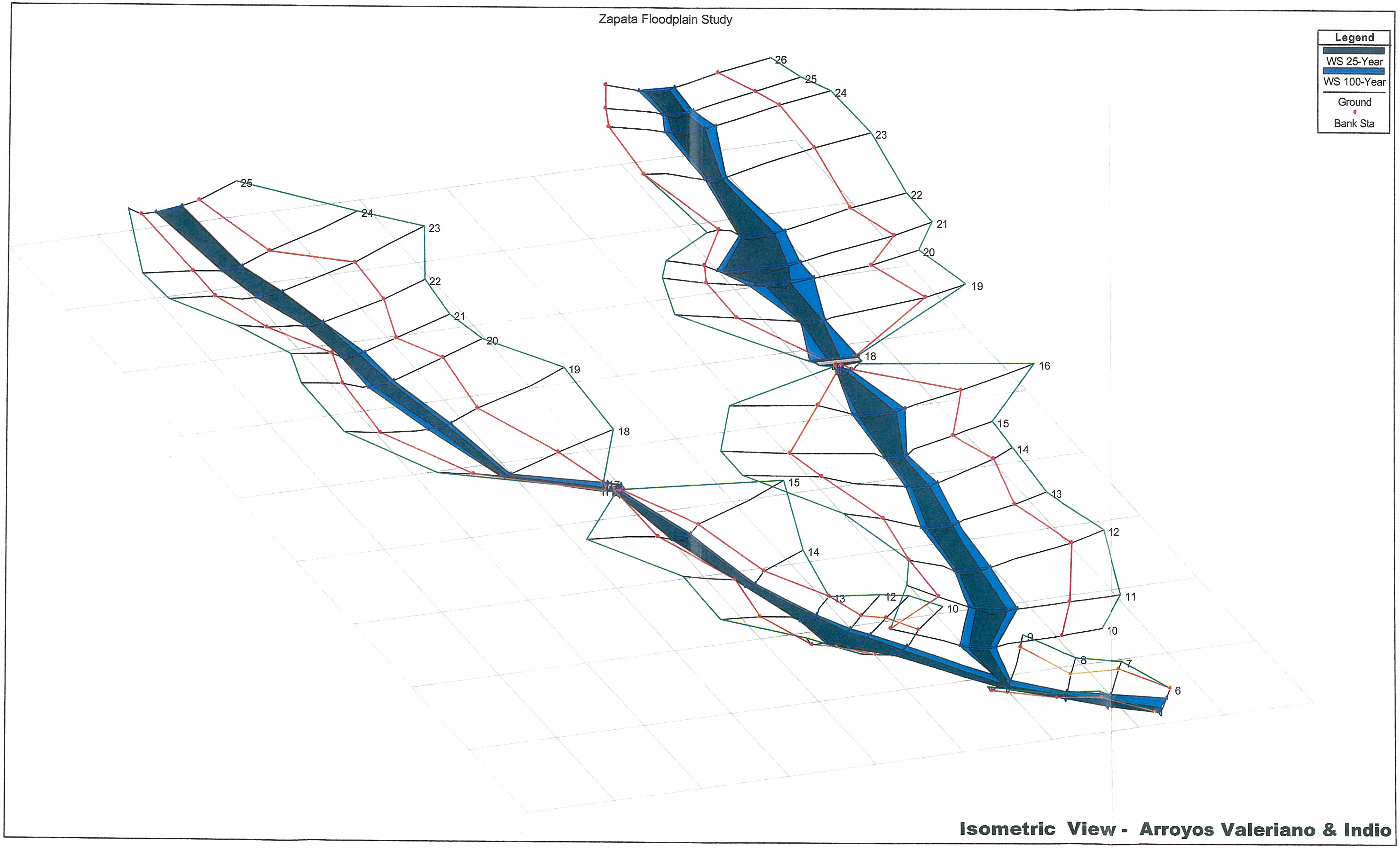


FIG. 14 ISOMETRIC VIEW – ARROYOS VALERIANO & INDIO

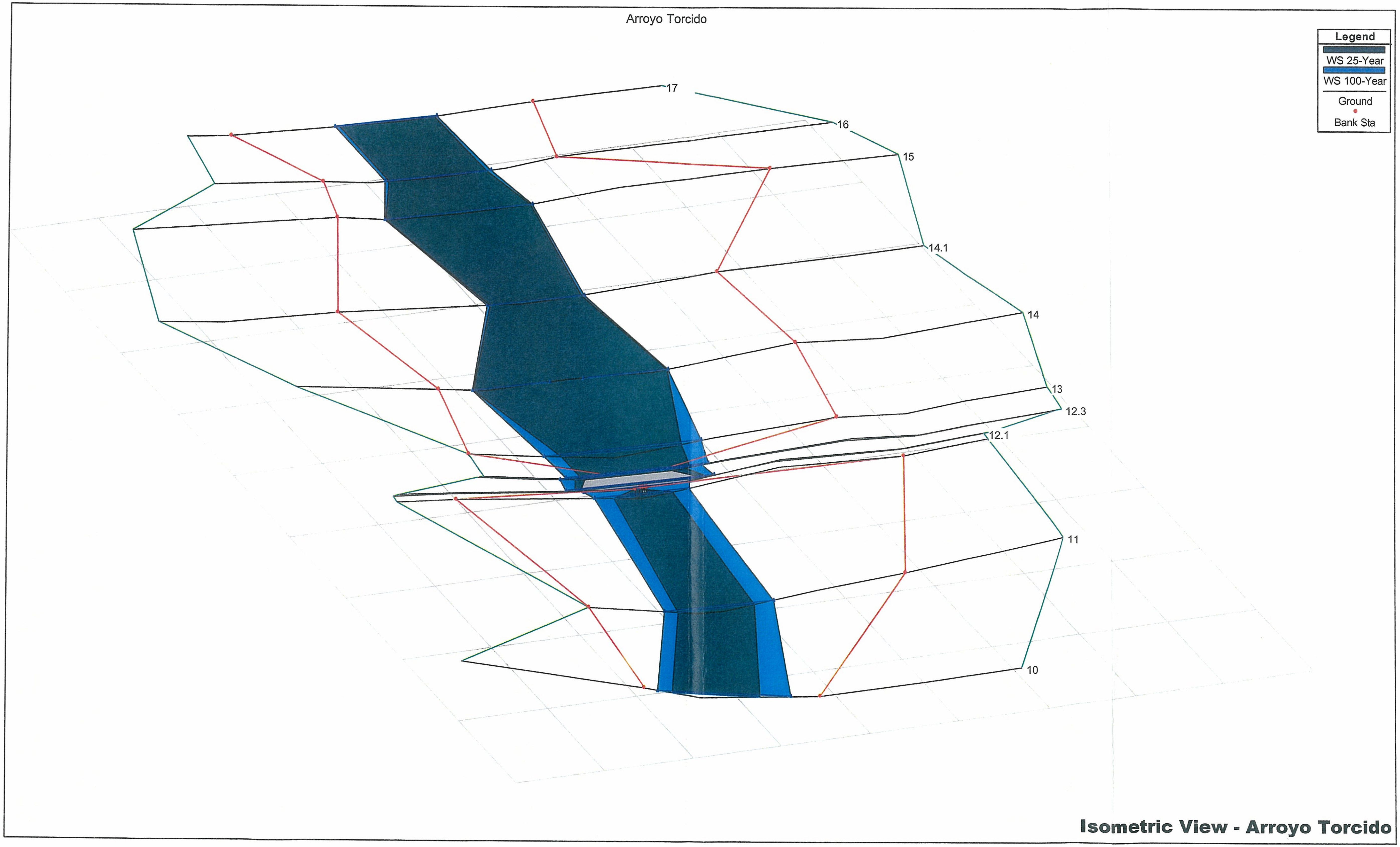
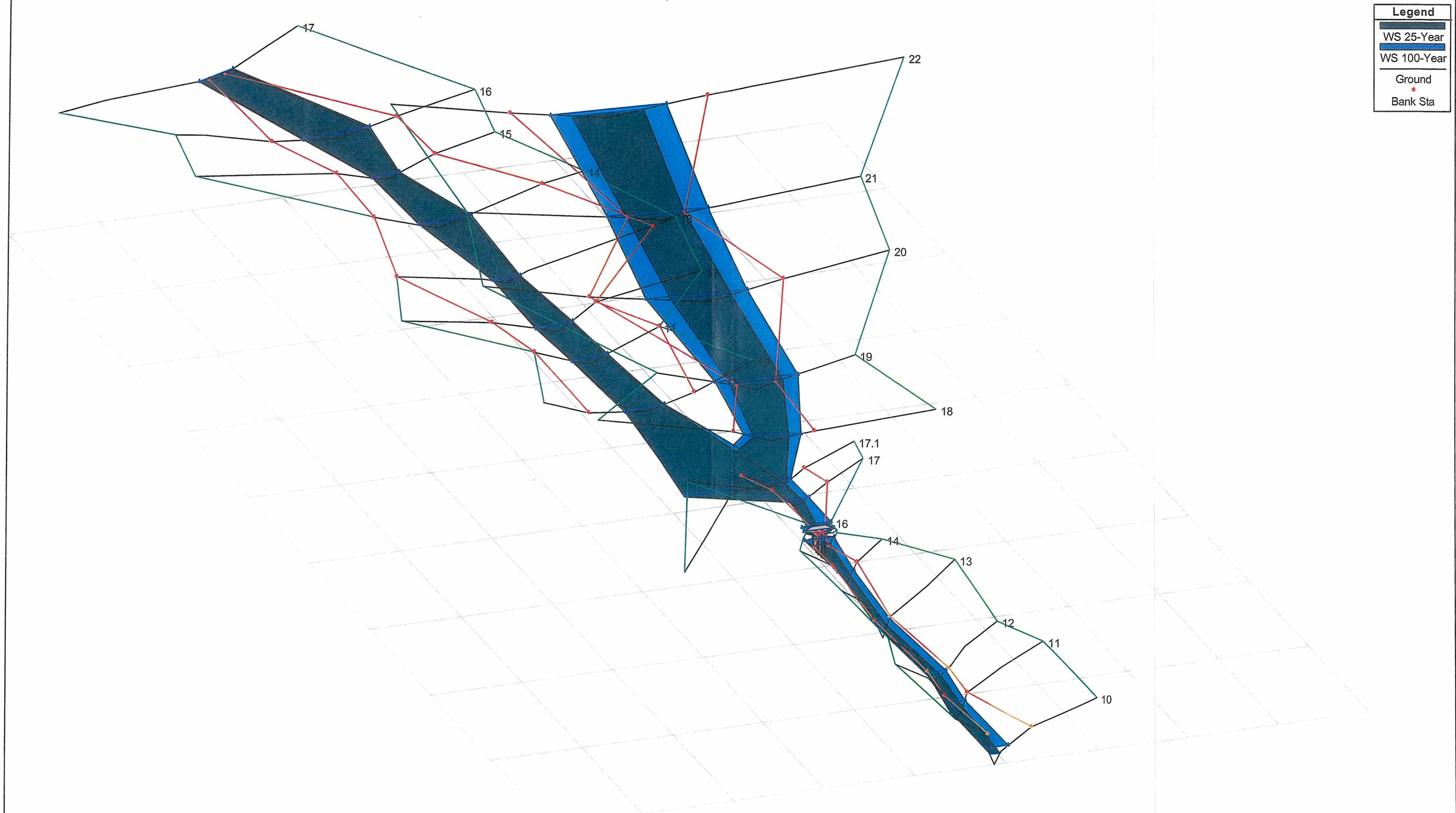


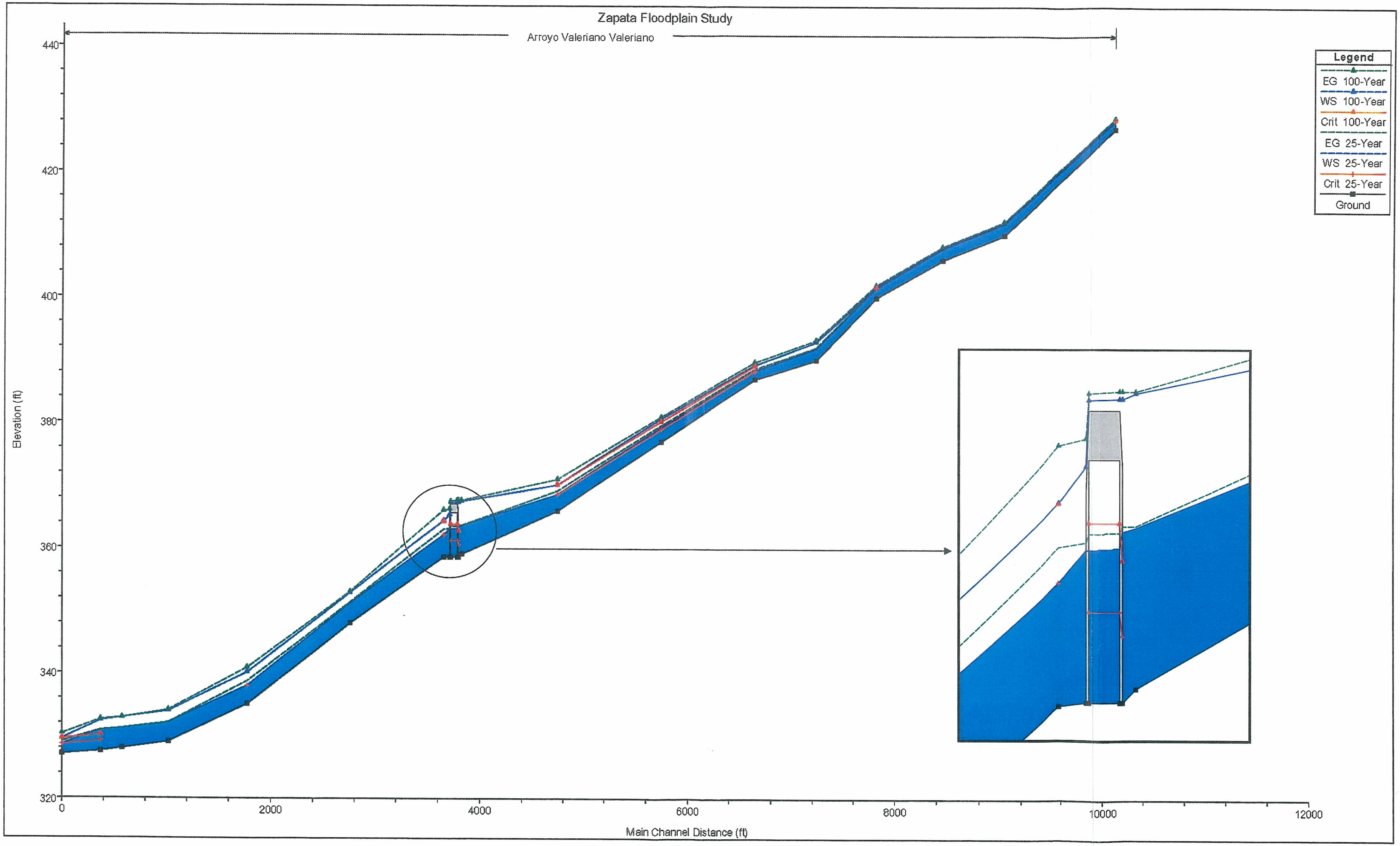
FIG. 15 ISOMETRIC VIEW – ARROYO TORCIDO

Arroyo Costa Rica



Isometric View - Arroyo Costa Rica

FIG. 16 ISOMETRIC VIEW – ARROYO COSTA RICA



Stream Profile - Arroyo Valeriano

FIG. 17 STREAM PROFILE – ARROYO VALERIANO

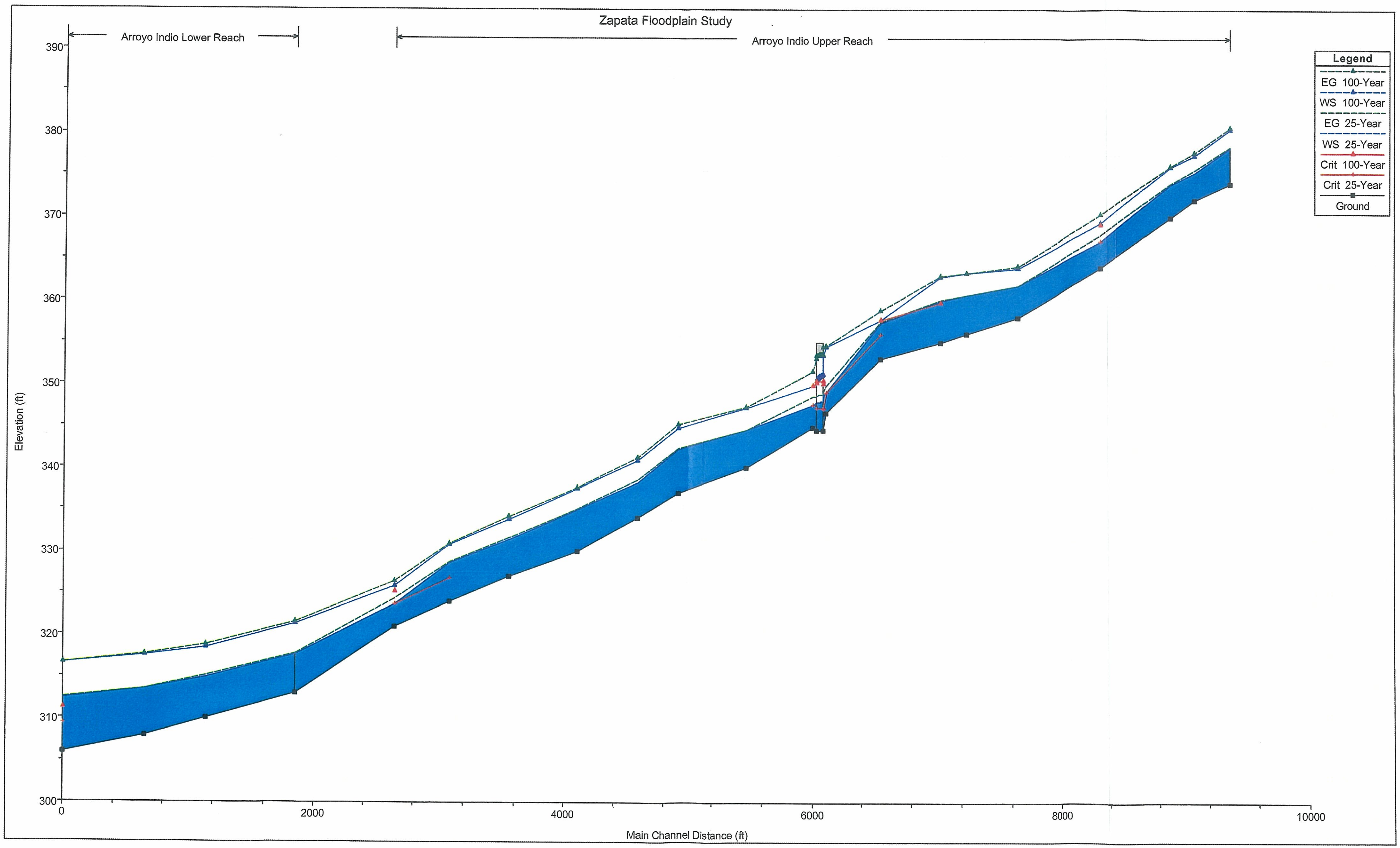


FIG. 18 STREAM PROFILE – ARROYO INDIO

Stream Profile - Arroyo Indio

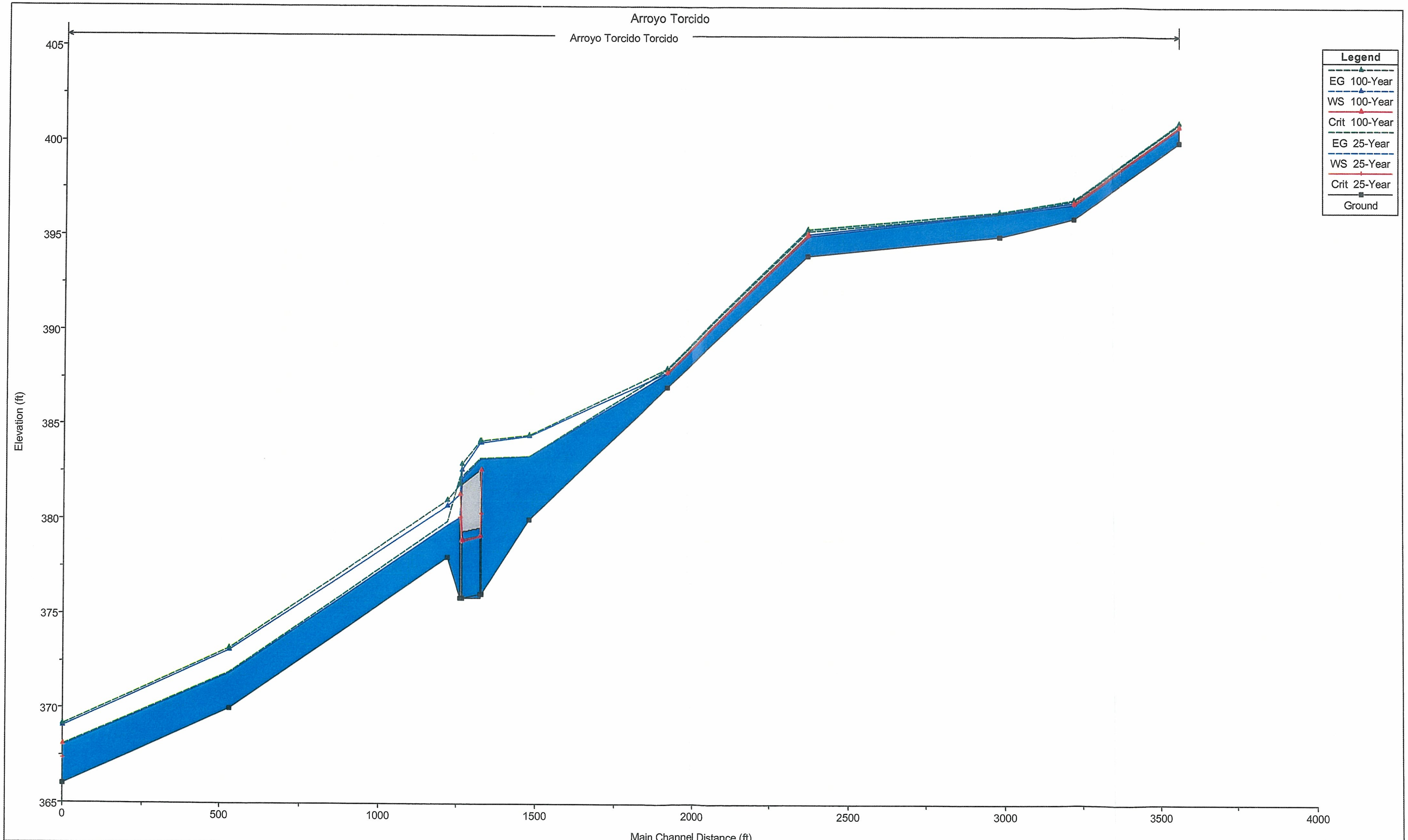


FIG. 19 STREAM PROFILE – ARROYO TORCIDO

Stream Profile - Arroyo Torcido

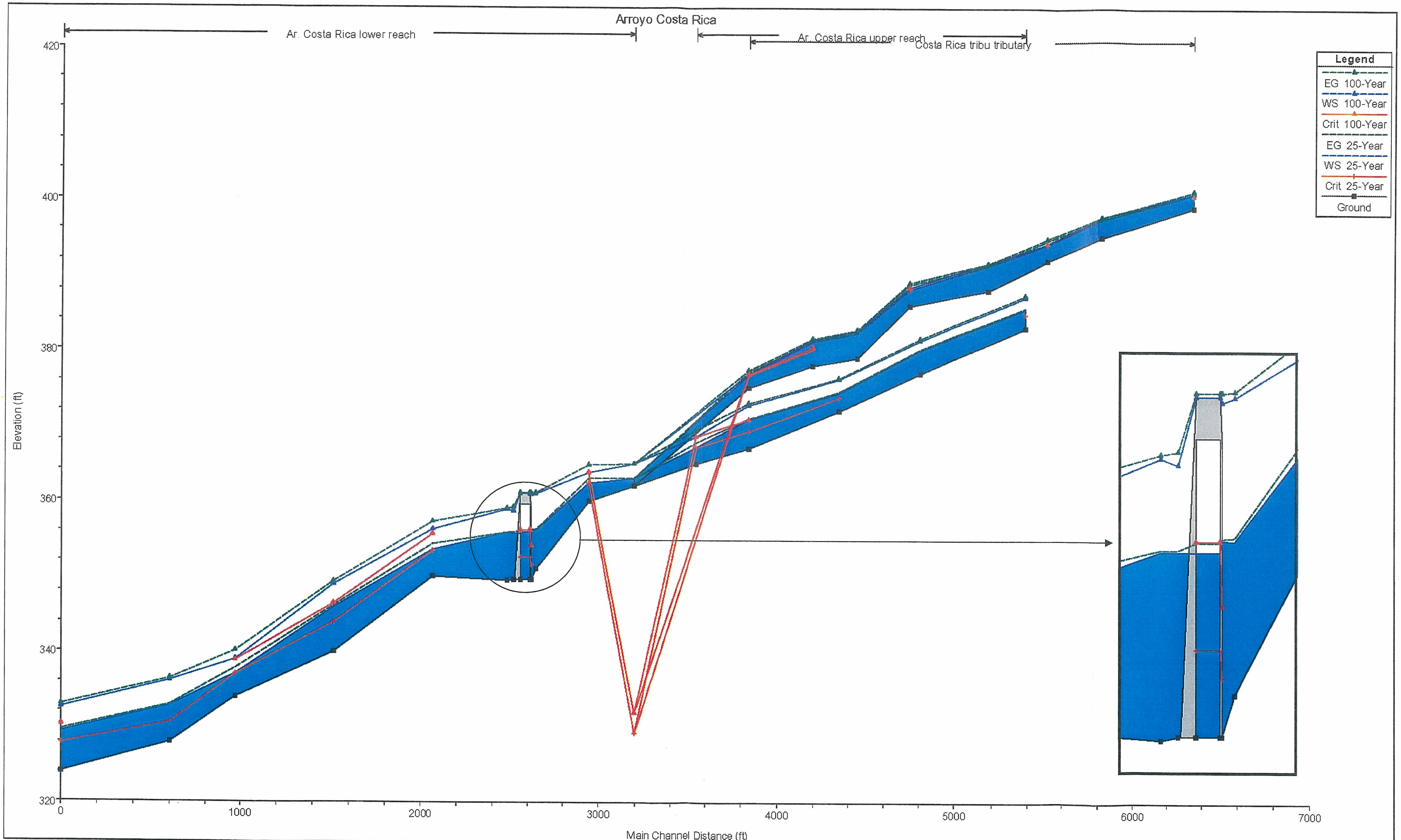
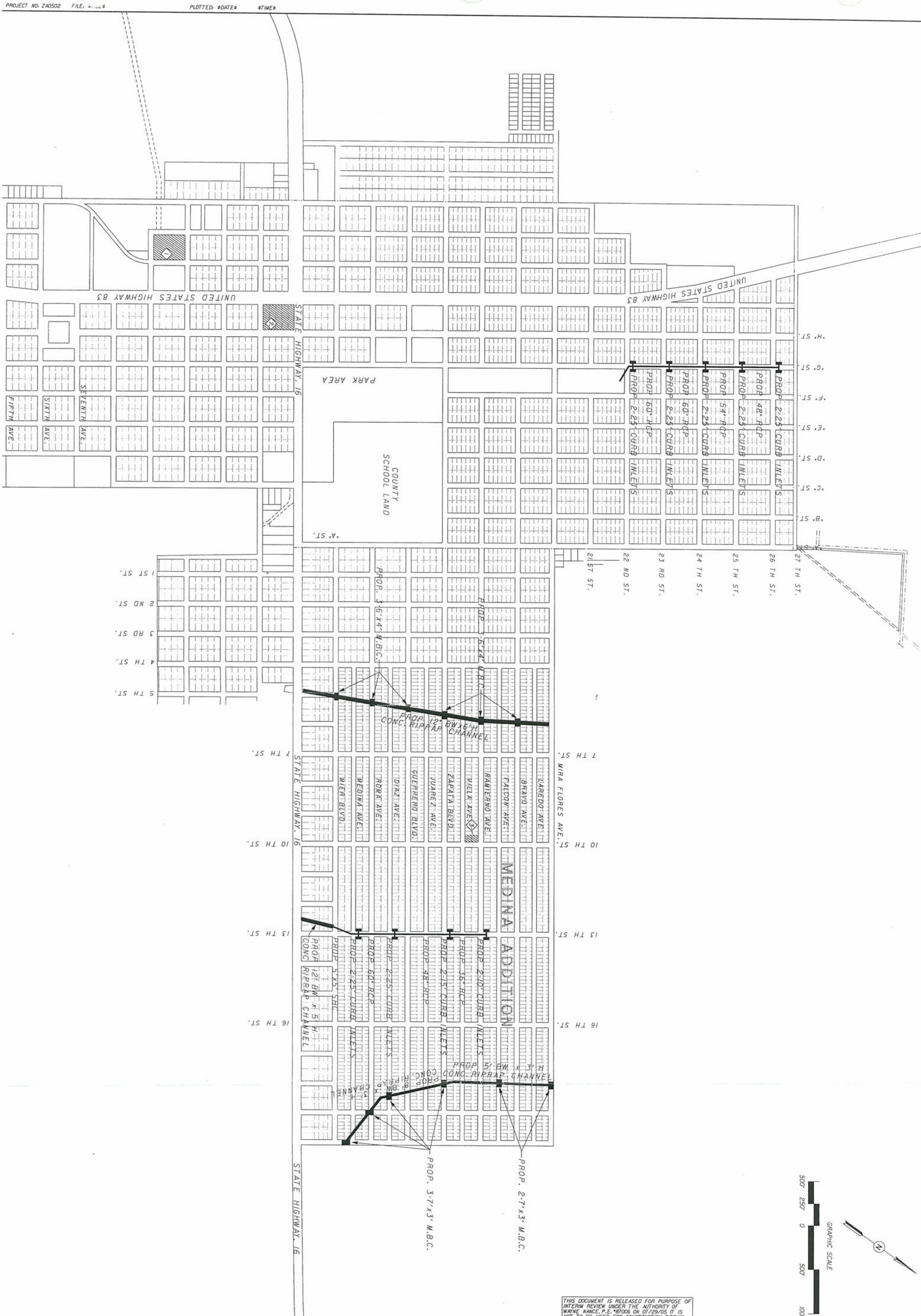


FIG. 20 STREAM PROFILE – ARROYO COSTA RICA

Stream Profile - Arroyo Costa Rica

PROJECT NO: ZA0502 FILE: PLOTTED: $DATE$ $TIME$



ZAPATA COUNTY, TEXAS
& 2005 FLOOD PLAIN STUDY

GARCIA & WRIGHT CONSULTING ENGINEERS, INC.

L.C.R.
DRAWN BY:
W.N.
CHECKED BY:

NO.	DATE	REVISIONS	BY

FIG. 21 PROPOSED DRAINAGE IMPROVEMENTS PLAN

TABLES

TABLE 7 RUNOFF CALCULATIONS

Point of Concentr.	Contribut. Area(s)	AREA (Acres)	Cummul AREA (Acres)	Cummul AREA (mi2)	Discharge 25-yr (cfs)	Discharge 100-yr (cfs)
PC-1	A1	181	181	0.283	503	829
PC-2	A2	280	461	0.720	503	1541
PC-3	A3	266	727	1.136	618	1883
PC-4	B1	1118	1118	1.747	707	2275
PC-5	B2	160	1278	1.997	733	2413
PC-6	B3	63	1341	2.095	750	2465
PC-7	B4	130	1471	2.298	811	2567
PC-8	B5	117	2315	3.617	1027	3134
PC-9	C1	60	60	0.094	337	405
PC-10	C2	51	111	0.173	500	649
PC-11	C3	336	447	0.698	500	1520
PC-12	D1	145	145	0.227	357	435
PC-13	D2	76	221	0.345	533	650
PC-14	D3	548	769	1.202	571	1930
	D4	116	885	1.383	658	2053
PC-15	D5	152	152	0.238	309	946
PC-16	D6	91	1128	1.763	673	2284
PC-17	D7	358	1486	2.322	787	2579

Refer to Figure 3: Drainage Area Map for corresponding areas and PC locatins
Discharges listed are calculated using Regional Regression Equations (USGS, Water-Resource Investigations Report 96-4307)(Asquith, Slade, 1996).
PC-1, 9, 10, 12, and 13 areas fall under the regression equation applicable ranges. Runoff in these areas is calculated using the Rational Equation (See Table 2). However, 25-yr discharges are limited to the maximum value calculated at the downstream PC.

ZAPATA, TEXAS

FLOODPLAIN STUDY

TABLE 8 RUNOFF CALCULATIONS, SELECT AREAS - RATIONAL METHOD

POINT OF CONCENTR.	DRAINAGE AREA NO.	AREA (acres)	C	CA (acres)	Time of Concentration (min)			I25 (in/hr)	I100 (in/hr)	Q25 (cfs)	Q100 (cfs)
					Overland	Flow	Design				
PC-1	A1	181	0.70	127	4	27	31	5.41	6.54	685	829
PC-9	C1	60	0.70	42	4	11	15	8.01	9.65	337	405
PC-10	C1& C2	111	0.70	78		5	20	6.93	8.36	538	649
PC-12	D1	145	0.60	87	4	44	48	4.11	5.00	357	435
PC-13	D1& D2	221	0.65	144		12	56	3.71	4.52	533	650

Rainfall Intensity Coefficients (TxDOT)

Yr	e	b	d
25	0.785	99	9.6
100	0.760	108	9.0

Prepared by: Garcia & Wright Consulting Engineers, Inc.

TABLE 9 NRCS TR-55 RUNOFF CALCULATION RESULTS & COMPARISON

Point of Concentration	NRCS TR-55 Discharge		Regression Discharge		% Regression Discharge	
	25-yr (cfs)	100-yr (cfs)	25-yr (cfs)	100-yr (cfs)	25-yr (cfs)	100-yr (cfs)
PC-2	1341	1912	503	1541	267%	124%
PC-6	2967	4252	750	2465	395%	173%
PC-10	342	487	500	649	68%	75%
PC-14	1401	2037	571	1930	245%	106%

NRCS TR-55 Method evaluated for comparison only at select concentraion points (PC) along SH16
Refer to Appendix for detailed NRCS TR-55 Computation Sheets
Soils Map for Zapata County is not complete per NRCS - only the General Soils Map shown in Figure 4

TABLE 10 ARROYO VALERIANO – HEC RAS HYDRAULIC OUTPUT TABLES

25-YR STORM EVENT

Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Valeriano	25	685	427	428.24	428.24	428.55	0.0216	4.53	151.35	244.82	1.01
Valeriano	24	685	410	411.86		412.09	0.0091	3.86	177.33	190.76	0.71
Valeriano	23	685	406	407.85		407.99	0.0056	3.01	227.64	245.61	0.55
Valeriano	22	685	400	401.57	401.57	401.97	0.0199	5.09	134.56	171.78	1.01
Valeriano	21	503	390	391.91		392.01	0.0027	2.55	197.00	160.24	0.41
Valeriano	20	503	387	388.45	388.38	388.74	0.0162	4.35	115.67	160.01	0.90
Valeriano	19	503	377	379.38	378.98	379.63	0.0069	3.96	126.88	106.47	0.64
Valeriano	18	503	366	368.57	368.57	369.24	0.0170	6.53	77.06	59.86	1.01
Valeriano	17	503	359	363.64		363.70	0.0005	1.84	273.39	85.17	0.18
Valeriano	16.3	503	358.61	363.53	360.54	363.68	0.0001	3.10	162.34	33.00	0.25
Valeriano	16.2	Culvert		*							
Valeriano	16.1	503	358.61	362.99		363.20	0.0001	3.71	135.74	31.00	0.31
Valeriano	16	618	358.5	362.05	362.05	363.07	0.0584	8.11	76.16	37.36	1.00
Valeriano	15	618	348	351.23		351.32	0.0053	2.28	271.37	151.37	0.30
Valeriano	14	618	335	337.98	337.98	338.73	0.0640	6.97	88.66	59.55	1.01
Valeriano	13	618	329	332.09		332.15	0.0031	1.96	314.56	146.90	0.24
Valeriano	12	618	328	331.21		331.23	0.0014	1.21	512.80	279.51	0.16
Valeriano	11	618	327.5	330.90	329.16	330.92	0.0016	1.28	482.88	262.94	0.17
Valeriano	10	618	327	328.65	328.65	329.07	0.0769	5.18	119.36	144.67	1.00

100-YR STORM EVENT

Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Valeriano	25	829	427	428.33	428.33	428.68	0.0210	4.70	176.30	264.23	1.01
Valeriano	24	829	410	412.00		412.25	0.0091	4.04	205.19	205.20	0.71
Valeriano	23	829	406	407.99		408.14	0.0056	3.17	261.45	263.22	0.56
Valeriano	22	829	400	401.69	401.69	402.13	0.0194	5.29	156.78	185.43	1.01
Valeriano	21	1541	390	393.05		393.26	0.0034	3.68	418.83	228.49	0.48
Valeriano	20	1541	387	389.28	389.16	389.73	0.0134	5.36	287.54	252.28	0.88
Valeriano	19	1541	377	380.73	380.16	381.06	0.0072	4.63	332.50	227.90	0.68
Valeriano	18	1541	366	370.09	370.09	371.06	0.0144	7.92	194.62	99.99	1.00
Valeriano	17	1541	359	367.50		367.58	0.0004	2.21	704.93	129.00	0.16
Valeriano	16.3	1541	358.61	367.36	362.69	367.56	0.0001	4.02	489.02	130.00	0.24
Valeriano	16.2	Culvert		*							
Valeriano	16.1	1541	358.61	365.40		366.20	0.0004	7.22	227.66	82.79	0.49
Valeriano	16	1883	358.5	364.34	364.32	366.03	0.0486	10.41	181.21	55.44	0.99
Valeriano	15	1883	348	352.87		353.04	0.0065	3.34	563.73	206.16	0.36
Valeriano	14	1883	335	340.16		340.94	0.0316	7.06	266.59	103.41	0.78
Valeriano	13	1883	329	333.95		334.09	0.0040	3.02	622.90	184.99	0.29
Valeriano	12	1883	328	332.89		332.94	0.0017	1.78	1059.27	370.48	0.19
Valeriano	11	1883	327.5	332.49	330.08	332.55	0.0021	1.94	969.62	348.16	0.21
Valeriano	10	1883	327	329.59	329.59	330.23	0.0651	6.43	292.98	226.65	1.00

* Roadway Elevation at Culvert = 367.00

ZAPATA, TEXAS

FLOODPLAIN STUDY

TABLE 11 ARROYO INDIO

HEC RAS HYDRAULIC OUTPUT TABLES

25-YR STORM EVENT

Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Upper Reach	26	707	374	378.28		378.40	0.0060	2.72	259.53	121.27	0.33
Upper Reach	25	707	372	375.28		375.56	0.0202	4.20	168.52	102.63	0.58
Upper Reach	24	733	370	373.87		373.94	0.0042	2.13	344.54	178.04	0.27
Upper Reach	23	733	364	367.09	367.09	367.87	0.0622	7.06	103.76	67.06	1.00
Upper Reach	22	733	358	361.73		361.79	0.0031	1.97	372.87	171.97	0.24
Upper Reach	21	733	356	360.62		360.66	0.0026	1.42	516.39	341.83	0.20
Upper Reach	20	750	355	359.89		359.98	0.0039	2.41	310.93	127.15	0.27
Upper Reach	19	750	353	357.22	355.85	357.37	0.0079	3.10	242.12	114.64	0.38
Upper Reach	18	750	346.5	348.92	348.92	349.75	0.0622	7.34	102.25	62.39	1.01
Upper Reach	17.3	750	344.46	348.59	346.97	349.06	0.0003	5.51	136.14	33.00	0.48
Upper Reach	17.2	Culvert		*							
Upper Reach	17.1	750	344.46	347.81		348.57	0.0007	6.99	107.31	32.00	0.67
Upper Reach	17	811	344.8	347.45	347.45	348.46	0.0585	8.07	100.46	50.25	1.01
Upper Reach	16	811	340	344.46		344.51	0.0022	1.74	466.16	201.28	0.20
Upper Reach	15	811	337	342.12		342.34	0.0088	3.77	214.84	81.82	0.41
Upper Reach	14	811	334	338.20		338.48	0.0151	4.25	190.67	90.90	0.52
Upper Reach	13	811	330	334.93		335.02	0.0041	2.47	327.90	133.07	0.28
Upper Reach	12	811	327	331.35		331.55	0.0109	3.57	227.24	110.61	0.44
Upper Reach	11	811	324	328.62	326.71	328.70	0.0038	2.28	356.31	154.12	0.26
Upper Reach	10	811	321	323.63	323.63	324.31	0.0673	6.60	122.87	93.47	1.01
Lower Reach	9	1027	313	317.67		317.75	0.0020	2.31	444.69	115.28	0.21
Lower Reach	8	1027	310	314.86		315.10	0.0094	3.93	261.36	98.63	0.43
Lower Reach	7	1027	308	313.48		313.53	0.0015	1.85	553.97	160.90	0.18
Lower Reach	6	1027	306	312.38	309.34	312.45	0.0019	2.14	480.10	135.66	0.20

100-YR STORM EVENT

Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Upper Reach	26	2275	374	380.44		380.67	0.0073	3.86	588.72	188.45	0.39
Upper Reach	25	2275	372	377.29		377.71	0.0165	5.20	437.39	165.34	0.56
Upper Reach	24	2413	370	375.98		376.11	0.0045	2.94	821.25	274.87	0.30
Upper Reach	23	2413	364	369.22	368.98	370.26	0.0414	8.17	295.49	113.16	0.89
Upper Reach	22	2413	358	363.89		364.03	0.0038	2.97	813.41	236.65	0.28
Upper Reach	21	2413	356	363.25		363.29	0.0010	1.57	1535.52	433.80	0.15
Upper Reach	20	2465	355	362.84	359.66	362.93	0.0033	2.49	991.00	339.81	0.26
Upper Reach	19	2465	353	357.59	357.59	358.74	0.0545	8.61	286.36	124.68	1.00
Upper Reach	18	2465	346.5	354.42		354.55	0.0023	3.02	908.76	249.51	0.23
Upper Reach	17.3	2465	344.46	353.33	350.02	354.43	0.0004	8.42	292.63	33.00	0.50
Upper Reach	17.2	Culvert		*							
Upper Reach	17.1	2465	344.46	350.13	350.13	353.00	0.0015	13.58	181.56	32.00	1.00
Upper Reach	17	2567	344.8	349.84	349.84	351.56	0.0493	10.54	243.56	71.27	1.00
Upper Reach	16	2567	340	347.15		347.23	0.0019	2.31	1109.87	278.24	0.20
Upper Reach	15	2567	337	344.70		345.15	0.0105	5.40	475.73	120.51	0.48
Upper Reach	14	2567	334	340.77		341.18	0.0131	5.09	504.19	165.55	0.51
Upper Reach	13	2567	330	337.40		337.59	0.0047	3.47	739.06	199.77	0.32
Upper Reach	12	2567	327	333.82		334.11	0.0089	4.34	591.30	184.60	0.43
Upper Reach	11	2567	324	330.74		330.92	0.0053	3.37	760.86	234.09	0.33
Upper Reach	10	2567	321	325.80	325.18	326.41	0.0270	6.25	410.44	170.84	0.71
Lower Reach	9	3134	313	321.35		321.53	0.0029	3.37	930.60	179.66	0.26
Lower Reach	8	3134	310	318.46		318.79	0.0055	4.60	681.24	134.63	0.36
Lower Reach	7	3134	308	317.53		317.61	0.0012	2.26	1385.08	252.33	0.17
Lower Reach	6	3134	306	316.58	311.17	316.65	0.0019	2.19	1430.89	391.87	0.20

Roadway Elevation at Culvert = 355.00

ZAPATA, TEXAS
FLOODPLAIN STUDY

TABLE 12 ARROYO TORCIDO

25-YR STORM EVENT

HEC RAS HYDRAULIC OUTPUT TABLES

Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Torcido	17	337	400	400.74	400.74	400.93	0.0068	3.50	96.23	259.54	1.01
Torcido	16	337	396	396.72	396.72	396.91	0.0068	3.47	97.22	268.22	1.01
Torcido	15	337	395	396.17		396.20	0.0004	1.31	257.82	397.45	0.29
Torcido	14.1	538	394	395.02	395.02	395.29	0.0061	4.14	130.02	253.27	1.02
Torcido	14	538	387	387.75	387.75	387.94	0.0067	3.50	153.87	411.41	1.01
Torcido	13	500	380	383.34		383.35	0.0009	0.92	545.74	327.06	0.12
Torcido	12.3	500	376.06	383.20	380.32	383.22	0.0006	1.77	451.98	296.26	0.12
Torcido	12.2	Culvert		*							
Torcido	12.1	500	375.84	380.09	380.09	382.24	0.0418	11.75	42.55	10.00	1.00
Torcido	12	500	378	379.68		379.90	0.0384	3.71	134.85	160.07	0.71
Torcido	11	500	370	371.85		371.91	0.0055	1.84	271.20	212.77	0.29
Torcido	10	500	366	368.00	367.34	368.07	0.0100	2.12	235.35	235.18	0.37

100-YR STORM EVENT

Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Torcido	17	405	400	400.80	400.80	401.00	0.0066	3.64	111.28	279.10	1.02
Torcido	16	405	396	396.78	396.78	396.98	0.0067	3.60	112.57	288.62	1.02
Torcido	15	405	395	396.25		396.28	0.0005	1.40	289.56	405.35	0.29
Torcido	14.1	649	394	395.10	395.10	395.39	0.0059	4.33	149.86	265.81	1.02
Torcido	14	649	387	387.80	387.80	388.01	0.0066	3.66	177.45	441.81	1.02
Torcido	13	1520	380	384.40		384.44	0.0020	1.60	949.87	431.48	0.19
Torcido	12.3	1520	376.06	384.07	382.60	384.14	0.0016	3.06	751.09	390.10	0.19
Torcido	12.2	Culvert		*							
Torcido	12.1	1520	375.84	381.35	381.35	381.84	0.0119	7.33	287.65	288.29	0.55
Torcido	12	1520	378	380.71		381.01	0.0278	4.35	349.33	256.08	0.66
Torcido	11	1520	370	373.09		373.19	0.0060	2.58	589.42	301.47	0.33
Torcido	10	1520	366	369.04	368.10	369.16	0.0100	2.80	541.97	356.88	0.40

* Roadway Elevation at Culvert = Upstream - 382.63
Downstream - 381.84

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TABLE 13 ARROYO COSTA RICA

25-YR STORM EVENT

HEC RAS HYDRAULIC OUTPUT TABLES

Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
upper reach	22	571	383	385.54	384.73	385.63	0.0099	2.48	230.29	181.38	0.39
upper reach	21	571	377	380.02		380.14	0.0091	2.67	213.50	142.13	0.38
upper reach	20	571	372	374.44	373.84	374.59	0.0169	3.14	181.65	149.17	0.50
upper reach	19	571	367	370.85	369.35	370.94	0.0040	2.38	249.90	134.13	0.27
upper reach	18	571	365	367.18	367.18	367.74	0.0716	6.01	95.01	87.18	1.01
lower reach	17.1	571	362	363.02	329.22	363.02	0.0000	0.01	5645.80	344.10	0.00
lower reach	17	571	360	362.35	362.35	362.96	0.0698	6.24	91.45	77.69	1.01
lower reach	16	571	351	356.16		356.28	0.0033	2.83	201.73	54.90	0.26
lower reach	15.3	571	349.61	356.18	351.55	356.26	0.0000	2.35	243.04	37.00	0.16
lower reach	15.2	Culvert		*							
lower reach	15.1	571	349.61	355.79		355.87	0.0000	2.37	240.83	39.00	0.17
lower reach	15	673	349.5	355.80		355.86	0.0011	1.84	372.06	106.12	0.16
lower reach	14	673	350	353.50	353.46	354.33	0.0568	7.31	92.09	52.56	0.97
lower reach	13	673	340	345.91	343.91	346.10	0.0066	3.50	192.15	65.02	0.36
lower reach	12	673	334	336.98	336.98	337.74	0.0647	7.01	96.00	64.50	1.01
lower reach	11	673	328	332.76	330.59	332.87	0.0034	2.63	256.16	82.09	0.26
lower reach	10	673	324	329.34	327.83	329.59	0.0100	4.05	166.25	62.28	0.44

100-YR STORM EVENT

Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
upper reach	22	1930	383	387.15		387.30	0.0082	3.14	615.59	296.55	0.38
upper reach	21	1930	377	381.30		381.61	0.0118	4.58	464.97	251.90	0.48
upper reach	20	1930	372	376.18		376.38	0.0108	3.61	535.12	256.03	0.44
upper reach	19	1930	367	372.78	370.83	372.98	0.0047	3.82	581.50	211.00	0.33
upper reach	18	1930	365	368.57	368.57	369.46	0.0591	7.58	254.45	142.67	1.00
lower reach	17.1	1930	362	364.91	331.87	364.91	0.0000	0.05	6396.56	448.78	0.01
lower reach	17	1930	360	363.85	363.85	364.82	0.0578	7.89	244.73	127.09	1.00
lower reach	16	1930	351	360.98		361.16	0.0023	3.48	570.93	125.96	0.24
lower reach	15.3	1930	349.61	360.83	354.00	361.14	0.0001	4.55	450.99	77.02	0.24
lower reach	15.2	Culvert		*							
lower reach	15.1	1930	349.61	358.72		359.18	0.0001	5.43	355.27	39.00	0.32
lower reach	15	2284	349.5	358.92		359.07	0.0016	3.21	809.21	176.01	0.21
lower reach	14	2284	350	356.30	355.65	357.21	0.0287	7.67	297.62	94.49	0.76
lower reach	13	2284	340	348.95	346.37	349.37	0.0083	5.18	440.58	98.45	0.43
lower reach	12	2284	334	338.94	338.87	340.10	0.0500	8.64	264.35	107.03	0.97
lower reach	11	2284	328	336.17		336.41	0.0037	3.92	582.84	109.39	0.30
lower reach	10	2284	324	332.53	330.27	332.93	0.0100	5.10	447.55	118.01	0.46

* Roadway Elevation at Culvert = 361.00

ZAPATA, TEXAS

FLOODPLAIN STUDY

Nov-08

TABLE 14 VALERIANO DRAINAGE IMPROVEMENTS

PRELIMINARY ESTIMATE OF PROBABLE CONSTRUCTION COST

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
	STORM SEWER SYSTEM - G-STREET				
1	MOBILIZATION	LS	1	10%	$95,118
2	25' CURB INLETS	EA	10	$10,600	$106,000
3	36" STORM DRAINAGE PIPE, RCP LATERALS	LF	300	$150	$45,000
4	48" STORM DRAINAGE PIPE, RCP	LF	410	$180	$73,800
5	54" STORM DRAINAGE PIPE, RCP	LF	410	$220	$90,200
6	60" STORM DRAINAGE PIPE, RCP	LF	1,020	$230	$234,600
7	JUNCTION BOXES	EA	6	$6,600	$39,600
8	CONCRETE HEADWALL	EA	1	$9,000	$9,000
9	CONCRETE RIPRAP	SY	22	$80	$1,778
10	GRAVEL SUBGRADE FILLER	CY	3,000	$26	$78,000
11	STREET EXCAVATION	CY	2,800	$17	$47,600
12	HOT-MIX ASPHALT PAVEMENT (1.5" COMP. DEPTH)	SY	7,500	$11	$82,500
13	FLEXIBLE BASE (8" COMPACTED DEPTH)	SY	7,500	$8	$60,000
14	PRIME COAT	GAL	1,500	$5	$7,500
15	CONCRETE CURB & GUTTER	LF	3,600	$21	$75,600
	CONTINGENCIES			15%	$156,944
	SUBTOTAL CONSTRUCTION				**$1,203,240**
	ENGINEERING & SURVEY	LS		15%	$180,486
	RESIDENT INSPECTOR	HRS	320	$50.00	$16,000
	LEGAL & ADMINISTRATIVE	LS		3%	$36,097
	TOTAL ESTIMATED PROJECT COST				**$1,435,823**

** Estimate does NOT include potential utility relocation costs*

ZAPATA, TEXAS

FLOODPLAIN STUDY

Nov-08

TABLE 15 INDIO DRAINAGE IMPROVEMENTS

PRELIMINARY ESTIMATE OF PROBABLE CONSTRUCTION COST

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
	CONCRETE CHANNEL & BOX CULVERTS				
1	MOBILIZATION	LS	1	10%	$201,680
2	CHANNEL EXCAVATION	CY	15,500	$10	$155,000
3	CONCRETE RIPRAP (CLASS A CONCRETE)	SY	12,600	$80	$1,008,000
4	6'x4' CONCRETE CULVERTS	LF	720	$600	$432,000
5	CONCRETE HEADWALLS	EA	12	$9,000	$108,000
6	STREET EXCAVATION	CY	3,000	$17	$51,000
7	HOT-MIX ASPHALT PAVEMENT (1.5" COMP. DEPTH)	SY	8,100	$11	$89,100
8	FLEXIBLE BASE (8" COMPACTED DEPTH)	SY	8,100	$8	$64,800
9	PRIME COAT	GAL	1,620	$5	$8,100
10	CONCRETE CURB & GUTTER	LF	4,800	$21	$100,800
	CONTINGENCIES			15%	$332,772
	SUBTOTAL CONSTRUCTION				**$2,551,252**
	ENGINEERING & SURVEY	LS		12%	$306,150
	RESIDENT INSPECTOR	HRS	480	$50	$24,000
	LAND ACQUISITION	LOT	72	$5,000	$360,000
	LEGAL & ADMINISTRATIVE	LS		3%	$76,538
	TOTAL ESTIMATED PROJECT COST				**$3,317,940**

** Estimate does NOT include potential utility relocation costs*

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FLOODPLAIN STUDY

TABLE 16 TORCIDO DRAINAGE IMPROVEMENTS

PRELIMINARY ESTIMATE OF PROBABLE CONSTRUCTION COST

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
	STORM SEWER SYSTEM - 13th STREET				
1	MOBILIZATION	LS	1	10%	$108,901
2	10' CURB INLETS	EA	2	$5,400	$10,800
3	15' CURB INLETS	EA	2	$7,100	$14,200
4	25' CURB INLETS	EA	4	$10,600	$42,400
5	24" STORM DRAINAGE PIPE, RCP LATERALS	LF	60	$100	$6,000
6	36" STORM DRAINAGE PIPE, RCP LATERALS	LF	60	$150	$9,000
7	36" STORM DRAINAGE PIPE, RCP	LF	410	$150	$61,500
8	48" STORM DRAINAGE PIPE, RCP	LF	620	$180	$111,600
9	60" STORM DRAINAGE PIPE, RCP	LF	410	$230	$94,300
10	5'x5' CONCRETE CULVERTS	LF	300	$700	$210,000
11	JUNCTION BOXES	EA	5	$6,000	$30,000
12	GRAVEL SUBGRADE FILLER	CY	2,000	$26	$52,000
13	CHANNEL EXCAVATION	CY	1,630	$17	$27,710
14	CONCRETE RIPRAP (CLASS A CONCRETE)	SY	1,550	$80	$124,000
15	CONCRETE HEADWALLS	EA	1	$9,000	$9,000
16	STREET EXCAVATION	CY	4,000	$17	$68,000
17	HOT-MIX ASPHALT PAVEMENT (1.5" COMP. DEPTH)	SY	7,250	$11	$79,750
18	FLEXIBLE BASE (8" COMPACTED DEPTH)	SY	7,250	$8	$58,000
19	PRIME COAT	GAL	1,450	$5	$7,250
20	CONCRETE CURB & GUTTER	LF	3,500	$21	$73,500
	CONTINGENCIES			15%	$179,687
	SUBTOTAL CONSTRUCTION				**$1,377,598**
	ENGINEERING & SURVEY	LS		15%	$206,640
	RESIDENT INSPECTOR	HRS	320	$50.00	$16,000
	LAND ACQUISITION	LOT	10	$5,000	$50,000
	LEGAL & ADMINISTRATIVE	LS		3%	$41,328
	TOTAL ESTIMATED PROJECT COST				**$1,691,565**

** Estimate does NOT include potential utility relocation costs*

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FLOODPLAIN STUDY

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TABLE 17 COSTA RICA DRAINAGE IMPROVEMENTS

PRELIMINARY ESTIMATE OF PROBABLE CONSTRUCTION COST

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT
	CONCRETE CHANNEL & BOX CULVERTS				
1	MOBILIZATION	LS	1	10%	$138,985
2	CHANNEL EXCAVATION	CY	3,650	$17	$62,050
3	CONCRETE RIPRAP (CLASS A CONCRETE)	SY	5,950	$80	$476,000
4	7'x3' CONCRETE CULVERTS	LF	640	$700	$448,000
5	CONCRETE HEADWALLS	EA	10	$9,000	$90,000
6	STREET EXCAVATION	CY	3,000	$17	$51,000
7	HOT-MIX ASPHALT PAVEMENT (1.5" COMP. DEPTH)	SY	8,100	$11	$89,100
8	FLEXIBLE BASE (8" COMPACTED DEPTH)	SY	8,100	$8	$64,800
9	PRIME COAT	GAL	1,620	$5	$8,100
10	CONCRETE CURB & GUTTER	LF	4,800	$21	$100,800
	CONTINGENCIES			15%	$229,325
	SUBTOTAL CONSTRUCTION				**$1,758,160**
	ENGINEERING & SURVEY	LS		12%	$210,979
	RESIDENT INSPECTOR	HRS	480	$50	$24,000
	LAND ACQUISITION	LOT	60	$5,000	$300,000
	LEGAL & ADMINISTRATIVE	LS		3%	$52,745
	TOTAL ESTIMATED PROJECT COST				**$2,345,884**

** Estimate does NOT include potential utility relocation costs*

ZAPATA, TEXAS

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FLOODPLAIN STUDY

TABLE 18 SUMMARY OF PROPOSED DRAINAGE IMPROVEMENTS

PRELIMINARY ESTIMATE OF PROBABLE CONSTRUCTION COST

DESCRIPTION	AMOUNT
ARROYO/AREA	
VALERIANO	$1,435,823
INDIO	$3,317,940
TORCIDO	$1,691,565
COSTA RICA	$2,345,884
TOTAL ESTIMATED PROJECT COST	**$8,791,212**

APPENDIX

NRCS - TR55 Hydrologic Computation Sheets

PC-2 (AREA A) @ SH 16

Worksheet 2: Runoff Curve Number and Runoff

Project: 2005 Zapata Floodplain Study
Location: Zapata, Texas
Date: July 2005
Developed / Undeveloped: Developed

1. Runoff Curve Number (CN):

Soil Name & Hydrological Group (Appendix A)	Cover Description cover type, treatment, hydrologic condition; percent impervious; unconnected/connected impervious area ratio	CN			Area		Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4	x	acres / sqr. mi / %	
Copita, B	Residential & Commercial 1/4 Acre	75				230.5	17287.5
Zapata, C	Residential & Commercial 1/4 Acre	83				230.5	19131.5
				Totals =		**461**	**36419**

Weighted CN = **79**
S = **2.66**

2. Runoff:

			Storm #1	Storm #2	Storm #3
Frequency	(yr)			25	100
Rainfall	(hr)			24	24
TxDOT constants (if applic.)	e	=		0.785	0.76
	b	=		99	108
	d	=		9.6	9
I	(in/hr)	=		0.33	0.43
P	(in)	=		7.84	10.26
Runoff, Q	**(in)**	=		**5.36**	**7.64**

Worksheet 3: Time of Concentration (Tc) or Travel Time (Tt)

Project: 2005 Zapata Floodplain Study
Location: Zapata, Texas
Date: July 2005
Developed / Present Condition:

Sheet Flow (Applicable to Tc only)		Segment ID			
1. Surface description (Table 3-1)		Desert Range			
2. Manning's roughness coeff., n (Table 3-1)		0.13			
3. Flow length, L (total L< 300 ft.)	(ft)	300			
4. Two-yr 24-hr rainfall, P2 *assuming Zapata County (e=.832; b=71; d=9	(in)	3.99			
5. Land slope, s	(ft/ft)	0.02			
6. Tt= (0.007(nL)^0.8)/(P2^0.5*s^0.4)=	(hr)	**0.31**		Sum=	**0.314**

Shallow Concentrated Flow		Segment ID			
7. Surface description (type 'paved' or 'unpaved')		unpaved			
8. Flow length, L	(ft)	1310			
9. Watercoursed slope, s	(ft/ft)	0.0136			
10. Average velocity, V (Figure 3-1)	(ft/s)	1.88			
11. Tt=L/(3600V)	(hr)	0.19		Sum=	**0.193**

Channel Flow		Segment ID			
12. Cross sectional flow area, A	(ft^2)	70			
13. Wetted perimeter, Pw	(ft)	41			
14. Hydraulic radius, Rh	(ft)	1.71			
15. Channel slope, s	(ft/ft)	0.012			
16. Manning's roughness coeff., n		0.03			
17. Velocity	(ft/s)	7.75			
18. Flow Length, L	(ft)	6219			
19. Tt=L/(3600V)	(hr)	0.22		Sum=	**0.223**

20. Watershed or Subarea Tc or Tt:	(hr)			**Total:**	**0.73**

Worksheet 4: Graphical Peak Discharge Method

Project: 2005 Zapata Floodplain Study
Location: Zapata, Texas
Date: July 2005
Developed / Present Condition:

PC-2 (AREA A) @ SH 16

1. Data:

Drainage area 461 acres
Am= 0.72 mi²

Runoff Curve # CN= 79

Time of Conc. Tc= 0.73 hr

Rainfall Dist. Type = III (type II or III)

% of area covered by ponds/swamps = 0.0%

	Storm		
	#1	#2	#3
2. Frequency		25	100
3. Rainfall: duration (hr)		24	24
P (in)		7.84	10.26
4. Initail Abstraction Ia (in)		0.532	0.532
5. Ia/P		0.07	0.05
6. Unit Peak Dischrge, qu (csm/in)		347.37	347.37
7. Runoff, Q (in)		5.36	7.64
8. Pond/swamp adjustment factor: Fp		1.0	1.0
9. Peak Discharge, qp (cfs)	0.00	1340.73	1912.22

NRCS - TR55 Hydrologic Computation Sheets

PC-6 (AREA B) @ SH 16

Worksheet 2: Runoff Curve Number and Runoff

Project: 2005 Zapata Floodplain Study
Location: Zapata, Texas
Date: July 2005
Developed / Undeveloped: Developed

1. Runoff Curve Number (CN):

Soil Name & Hydrological Group (Appendix A)	Cover Description cover type, treatment, hydrologic condition; percent impervious; unconnected/connected impervious area ratio	CN			Area	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4	x acres / sqr. mi / %	
Copita, B	Residential & Commercial 1/4 Acre	75			536.4	40230
Zapata, C	Residential & Commercial 1/4 Acre	83			536.4	44521.2
Nueces, C	Desert Shrub; poor condition			85	134.1	11398.5
Comitas, A	Desert Shrub; poor condition			63	134.1	8448.3
				Totals =	**1341**	**104598**

Weighted CN	=	**78**
S	=	**2.82**

2. Runoff:

			Storm #1	Storm #2	Storm #3
Frequency	(yr)			25	100
Rainfall	(hr)			24	24
TxDOT constants (if applic.)	e	=		0.785	0.76
	b	=		99	108
	d	=		9.6	9
I	(in/hr)	=		0.33	0.43
P	(in)	=		7.84	10.26
Runoff, Q	**(in)**	**=**		**5.24**	**7.51**

Worksheet 3: Time of Concentration (Tc) or Travel Time (Tt)

Project: 2005 Zapata Floodplain Study
Location: Zapata, Texas
Date: July 2005
Developed / Present Condition:

Sheet Flow (Applicable to Tc only)		Segment ID			
1. Surface description (Table 3-1)		Desert Range			
2. Manning's roughness coeff., n (Table 3-1)		0.13			
3. Flow length, L (total L< 300 ft.)	(ft)	300			
4. Two-yr 24-hr rainfall, P2 *assuming Zapata County (e=.832; b=71; d=9	(in)	3.99			
5. Land slope, s	(ft/ft)	0.016		Sum=	
6. Tt= (0.007(nL)^0.8)/(P2^0.5*s^0.4)=	(hr)	**0.34**		**0.343**	

Shallow Concentrated Flow		Segment ID		
7. Surface description (type 'paved' or 'unpaved')		unpaved		
8. Flow length, L	(ft)	1540		
9. Watercoursed slope, s	(ft/ft)	0.016		
10. Average velocity, V (Figure 3-1)	(ft/s)	2.04		Sum=
11. Tt=L/(3600V)	(hr)	0.21		**0.21**

Channel Flow		Segment ID		
12. Cross sectional flow area, A	(ft^2)	340		
13. Wetted perimeter, Pw	(ft)	185		
14. Hydraulic radius, Rh	(ft)	1.84		
15. Channel slope, s	(ft/ft)	0.012		
16. Manning's roughness coeff., n		0.045		
17. Velocity	(ft/s)	5.43		
18. Flow Length, L	(ft)	12596		Sum=
19. Tt=L/(3600V)	(hr)	0.64		**0.645**

20. Watershed or Subarea Tc or Tt: (hr) **Total: 1.197**

Worksheet 4: Graphical Peak Discharge Method

Project: 2005 Zapata Floodplain Study
Location: Zapata, Texas
Date: July 2005
Developed / Present Condition:

PC-6 (AREA B) @ SH 16

1. Data:

Drainage area 1341 acres
Am= 2.10 mi²

Runoff Curve # CN= 78

Time of Conc. Tc= 1.20 hr

Rainfall Dist. Type = III (type II or III)

% of area covered
by ponds/swamps = 0.0%

	Storm		
	#1	#2	#3
2. Frequency		25	100
3. Rainfall: duration (hr)		24	24
P (in)		7.84	10.26
4. Initail Abstraction Ia (in)		0.564	0.564
5. Ia/P		0.07	0.05
6. Unit Peak Dischrge, qu (csm/in)		270.11	270.11
7. Runoff, Q (in)		5.24	7.51
8. Pond/swamp adjustment factor: Fp		1.0	1.0
9. Peak Discharge, qp (cfs)	0.00	2967.08	4251.93

<u>NRCS - TR55 Hydrologic Computation Sheets</u>

PC-10 (AREA C) @ SH 16

Worksheet 2: Runoff Curve Number and Runoff

Project: 2005 Zapata Floodplain Study
Location: Zapata, Texas
Date: July 2005
Developed / Undeveloped: Developed

1. Runoff Curve Number (CN):

Soil Name & Hydrological Group (Appendix A)	Cover Description cover type, treatment, hydrologic condition; percent impervious; unconnected/connected impervious area ratio	CN			Area	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4	x acres / sqr. mi / %	
Copita, B	Residential & Commercial 1/4 Acre	75			55.5	4162.5
Zapata, C	Residential & Commercial 1/4 Acre	83			55.5	4606.5
				Totals =	111	8769

Weighted CN = **79**
S = **2.66**

2. Runoff:

			Storm #1	Storm #2	Storm #3
Frequency	(yr)			25	100
Rainfall	(hr)			24	24
TxDOT constants (if applic.)	e	=		0.785	0.76
	b	=		99	108
	d	=		9.6	9
I	(in/hr)	=		0.33	0.43
P	(in)	=		7.84	10.26
Runoff, Q	**(in)**	**=**		**5.36**	**7.64**

Worksheet 3: Time of Concentration (Tc) or Travel Time (Tt)

Project: 2005 Zapata Floodplain Study
Location: Zapata, Texas
Date: July 2005
Developed / Present Condition:

Sheet Flow (Applicable to Tc only)				
	Segment ID			
1. Surface description (Table 3-1)		Desert Range		
2. Manning's roughness coeff., n (Table 3-1)		0.13		
3. Flow length, L (total L< 300 ft.)	(ft)	300		
4. Two-yr 24-hr rainfall, P2 *assuming Zapata County (e=.832; b=71; d=9	(in)	3.99		
5. Land slope, s	(ft/ft)	0.012		Sum=
6. Tt= (0.007(nL)^0.8)/(P2^0.5*s^0.4)=	(hr)	**0.39**		**0.385**

Shallow Concentrated Flow				
	Segment ID			
7. Surface description (type 'paved' or 'unpaved')		unpaved		
8. Flow length, L	(ft)	755		
9. Watercoursed slope, s	(ft/ft)	0.012		
10. Average velocity, V (Figure 3-1)	(ft/s)	1.77		Sum=
11. Tt=L/(3600V)	(hr)	0.12		**0.119**

Channel Flow				
	Segment ID			
12. Cross sectional flow area, A	(ft^2)	123		
13. Wetted perimeter, Pw	(ft)	160		
14. Hydraulic radius, Rh	(ft)	0.77		
15. Channel slope, s	(ft/ft)	0.013		
16. Manning's roughness coeff., n		0.025		
17. Velocity	(ft/s)	5.69		
18. Flow Length, L	(ft)	2912		Sum=
19. Tt=L/(3600V)	(hr)	0.14		**0.142**

20. Watershed or Subarea Tc or Tt:	(hr)	**Total:**	**0.646**

Worksheet 4: Graphical Peak Discharge Method

Project: 2005 Zapata Floodplain Study
Location: Zapata, Texas
Date: July 2005
Developed / Present Condition:

PC-10 (AREA C) @ SH 16

1. Data:

Drainage area 111 acres
Am= 0.17 mi²

Runoff Curve # CN= 79

Time of Conc. Tc= 0.65 hr

Rainfall Dist. Type = III (type II or III)

% of area covered by ponds/swamps = 0.0%

	Storm #1	Storm #2	Storm #3
2. Frequency		25	100
3. Rainfall: duration (hr)		24	24
P (in)		7.84	10.26
4. Initail Abstraction Ia (in)		0.532	0.532
5. Ia/P		0.07	0.05
6. Unit Peak Dischrge, qu (csm/in)		367.64	367.64
7. Runoff, Q (in)		5.36	7.64
8. Pond/swamp adjustment factor: Fp		1.0	1.0
9. Peak Discharge, qp (cfs)	0.00	341.66	487.29

NRCS - TR55 Hydrologic Computation Sheets

PC-14 (AREA D) @ SH 16

Worksheet 2: Runoff Curve Number and Runoff

Project: 2005 Zapata Floodplain Study
Location: Zapata, Texas
Date: July 2005
Developed / Undeveloped: Developed

1. Runoff Curve Number (CN):

Soil Name & Hydrological Group (Appendix A)	Cover Description cover type, treatment, hydrologic condition; percent impervious; unconnected/connected impervious area ratio	CN Table 2-2	CN Fig. 2-3	CN Fig. 2-4	Area (x acres / sqr. mi / %)	Product of CN x Area
Copita, B	Residential & Commercial 1/4 Acre	75			76.9	5767.5
Zapata, C	Residential & Commercial 1/4 Acre	83			76.9	6382.7
Nueces, C	Desert Shrub; poor condition			85	115.35	9804.75
Comitas, A	Desert Shrub; poor condition			63	115.35	7267.05
Copita, B	Desert Shrub; poor condition			63	192.25	12111.75
Zapata, C	Desert Shrub; poor condition			85	192.25	16341.25
				Totals =	**769**	**57675**

Weighted CN = **75**
S = **3.33**

2. Runoff:

			Storm #1	Storm #2	Storm #3
Frequency	(yr)			25	100
Rainfall	(hr)			24	24
TxDOT constants (if applic.)	e	=		0.785	0.76
	b	=		99	108
	d	=		9.6	9
I	(in/hr)	=		0.33	0.43
P	(in)	=		7.84	10.26
Runoff, Q	**(in)**	**=**		**4.90**	**7.12**

Worksheet 3: Time of Concentration (Tc) or Travel Time (Tt)

Project: 2005 Zapata Floodplain Study
Location: Zapata, Texas
Date: July 2005
Developed / Present Condition:

Sheet Flow (Applicable to Tc only)	Segment ID			
1. Surface description (Table 3-1)		Desert Range		
2. Manning's roughness coeff., n (Table 3-1)		0.13		
3. Flow length, L (total L< 300 ft.)	(ft)	300		
4. Two-yr 24-hr rainfall, P2 *assuming Zapata County (e=.832; b=71; d=9	(in)	3.99		
5. Land slope, s	(ft/ft)	0.01		Sum=
6. Tt= (0.007(nL)^0.8)/(P2^0.5*s^0.4)=	(hr)	**0.41**		**0.414**

Shallow Concentrated Flow	Segment ID			
7. Surface description (type 'paved' or 'unpaved')		unpaved		
8. Flow length, L	(ft)	2070		
9. Watercoursed slope, s	(ft/ft)	0.015		
10. Average velocity, V (Figure 3-1)	(ft/s)	1.98		Sum=
11. Tt=L/(3600V)	(hr)	0.29		**0.291**

Channel Flow	Segment ID			
12. Cross sectional flow area, A	(ft^2)	291		
13. Wetted perimeter, Pw	(ft)	188		
14. Hydraulic radius, Rh	(ft)	1.55		
15. Channel slope, s	(ft/ft)	0.014		
16. Manning's roughness coeff., n		0.045		
17. Velocity	(ft/s)	5.23		
18. Flow Length, L	(ft)	14946		Sum=
19. Tt=L/(3600V)	(hr)	0.79		**0.794**

20. Watershed or Subarea Tc or Tt: (hr) **Total: 1.499**

Worksheet 4: Graphical Peak Discharge Method

Project: 2005 Zapata Floodplain Study
Location: Zapata, Texas
Date: July 2005
Developed / Present Condition:

PC-14 (AREA D) @ SH 16

1. Data:

Drainage area 769 acres
Am= 1.20 mi²

Runoff Curve # CN= 75

Time of Conc. Tc= 1.50 hr

Rainfall Dist. Type = III (type II or III)

% of area covered by ponds/swamps = 0.0%

	Storm		
	#1	#2	#3
2. Frequency		25	100
3. Rainfall: duration (hr)		24	24
P (in)		7.84	10.26
4. Initail Abstraction Ia (in)		0.667	0.667
5. Ia/P		0.09	0.06
6. Unit Peak Dischrge, qu (csm/in)		238.07	238.07
7. Runoff, Q (in)		4.90	7.12
8. Pond/swamp adjust-ment factor: Fp		1.0	1.0
9. Peak Discharge, qp (cfs)	0.00	1400.71	2037.03

ATTACHMENTS

U.S. Department of Homeland Security
500 C Street, SW
Washington, DC 20472

FEMA

FEB 06 2007

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable David Morales
County Judge, Zapata County
Post Office 99
Zapata, Texas 78076

Dear Judge Morales:

I am happy to announce that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) has approved Zapata County's application to participate in the National Flood Insurance Program (NFIP). In accordance with Section 1336 of the National Flood Insurance Act of 1968, Zapata County is eligible to participate in the Emergency Phase of the NFIP effective on December 7, 2006. Flood insurance is now available to local property owners and may be purchased from any insurance agent or broker licensed to do business in the State where the insurable property is located.

I am enclosing a copy of the news release announcing Zapata County's eligibility to participate in the NFIP. I hope it assists you in your efforts to publicize the availability of this important coverage. Zapata County's property owners will want to know about this opportunity to obtain insurance protection against losses from future flooding. The buildings and contents coverage is now available to building owners and tenants.

There is a 30-day waiting period before a newly purchased flood insurance policy takes effect or for any additional coverage or endorsement that may increase policy limits. The waiting period ends and the policy takes effect at 12:01 a.m. on the 30th calendar day after the insurance policy application date and payment of premium.

There are 10 exceptions to the 30-day waiting period. However, I am only explaining the two most frequently used exceptions in this letter. The two most frequently used exceptions are: (1) when the initial purchase of flood insurance is in connection with the making, increasing, extension, or renewal of a loan, there is no waiting period and coverage is effective immediately; and (2) when the purchase of flood insurance is related to a revision or update of a Flood Hazard Boundary Map or Flood Insurance Rate Map (FIRM), there is a one-day waiting period. Flood insurance coverage takes effect at 12:01 a.m. on the day after the coverage is purchased for a structure located in a Special Flood Hazard Area (SFHA), an area subject to inundation by the base (1-percent-annual-chance) flood, on the revised flood map, which was not previously located in an SFHA prior to the revision. This exception is limited to a 13-month period and begins on the date the revised map is issued. The information on the remaining eight exceptions is contained in the enclosed NFIP "Policy Issuance 5-98" dated October 1, 1998.

Under the Flood Disaster Protection Act of 1973, as amended, flood insurance must be purchased by property owners seeking any Federal financial assistance for construction or acquisition of buildings in SFHAs. This financial assistance includes Federal Housing Administration insured and Department of Veterans Affairs and Rural Economic and Community Development Services guaranteed mortgages and direct loans, Federal disaster relief loans and grants, as well as other similarly described assistance from Federal agencies.

In addition, all loans individuals obtain from Federally regulated, supervised, or insured lending institutions that are secured by improved real estate located in SFHAs are also contingent upon the borrower obtaining flood insurance coverage on the building. However, purchasing and maintaining flood insurance coverage on a voluntary basis is frequently recommended for properties located outside SFHAs.

If you need additional assistance or information, I recommend you contact Mike Howard, CFM, the NFIP State Coordinator, by telephone at (512) 239-6155, in writing at the Texas Commission on Environmental Quality, Post Office Box 13087, MC 160, Austin, Texas 78711-3087, or by electronic mail at mhoward@tceq.state.tx.us. The FEMA Regional staff in Denton, Texas, is also available to assist you. You may contact the Regional staff by telephone at (940) 898-5399 or in writing. Please send your written inquiries to the Director, Federal Insurance and Mitigation Division, FEMA Region VI, at 800 North Loop 288, Denton, Texas 76209-3606.

Sincerely,

David I. Maurstad

David I. Maurstad
Director
Mitigation Division

Enclosures

cc: William E. Peterson, Regional Director, FEMA Region VI
Mike Howard, CFM, NFIP State Coordinator, Texas Commission on Environmental Quality
Mario Gonzalez-Davis, Project Director, Zapata County

CARLOS COLINA-VARGAS, AICP
& ASSOCIATES
Urban Planning and Management Consultants

ZAPATA COUNTY, TEXAS

PUBLIC HEARING - JULY 7, 2005

T.W.D.B. FLOOD PROTECTION PLANNING STUDY

Zapata County was awarded a grant from the Texas Water Development Board to conduct a flood protection study for the purpose of assessing the flood conditions that affect the urbanized area of the community of Zapata. The main purposes of the planning study are to determine the details of existing flooding conditions, to collect and interpret hydrologic data, and to plan and schedule the capital improvements necessary to alleviate the identified problems.

Public participation is an important element of this planning process. To allow residents adequate opportunity to participate, public hearings are conducted during the planning process and at completion of the project. Newspaper articles concerning the study and its findings will be published as the project progresses.

Zapata County greatly appreciates your attendance and participation in this public hearing. Written comments concerning the planning study will be accepted, and should be addressed to:

Zapata County Projects Coordinator
Attn: TWDB Flood Protection Study
P. O. Box 99
Zapata, TX 78076

Member of the American Institute of Certified Planners (AICP),
the American Planning Association (APA)
the City Planners Association of Texas (CPAT),
and the Texas Recreation and Park Society (TRAPS)

P.O. BOX 161540 AUSTIN, TEXAS 78716 PHONE (512) 892-1653 FAX (512) 892-2360

PART II - DETAILED SCOPE OF WORK

The proposed Scope of Work for the flood protection planning study has been designed to:

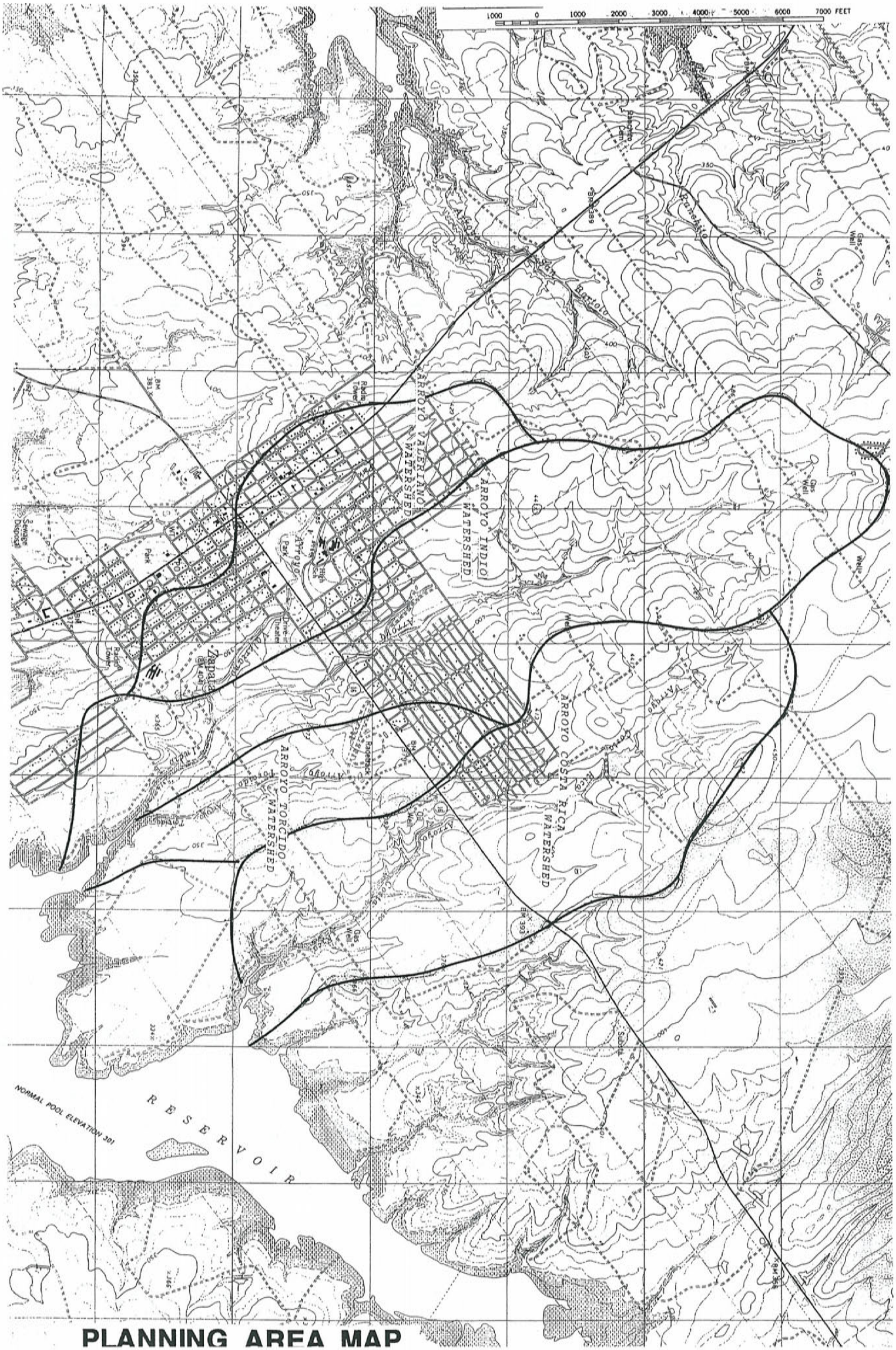
(1) address the existing flooding issues in the planning area;
(2) develop hydrologic and hydraulic models that can be updated and monitored;
(3) evaluate potential flood protection measures on a cost/benefit basis;
(4) develop land use and growth control roles; and
(5) involve the local residents in the planning process.

The following tasks are proposed.

TASK 1. Data collection and surveys
TASK 2. Land use and housing study
TASK 3. Hydrologic analysis (HEC-RAS software)
TASK 4. Hydraulic analysis (HEC-2, HED-RAS, and HYDRA or SWMM models)
TASK 5. Flood prevention and flood control alternatives
TASK 6. Financial and economic analysis of alternatives
TASK 7. Sources of funding
TASK 8. Flood Prevention Master Plan report
TASK 9. Coordination of public participation

Reports and Other Products

The Consultant will complete the Scope of Work and deliver seven (7) double-sided copies of the draft of the final report no later than the study completion date. After the TWDB staff reviews the study and submits comments, the Consultant will submit one (1) electronic copy, one (1) unbound, camera-ready original, and nine (9) bound, double-sided copies of the final report. The Consultant also will submit one (1) electronic copy of any computer programs, maps, or models, and an operations manual developed under the terms of this agreement.



PLANNING AREA MAP

Zapata County News

THURSDAY, February 22, 200

teacher and his uncle about what was happening in the home. A physician later examined the boy and determined that the boy was indeed telling the truth.

According to the boy's uncle, the child still has nightmares and dreams of voices threatening him. The child has also claimed that his father gave him alcohol and drugs.

No trial date has been set at this time for the accused individuals.

'ardens discovered 1,500 feet and the contraband on board custody of the Border Patrol. t were confiscated by Game

Federal Flood Insurance now available in Zapata County

Washington, D.C. – Zapata County has joined over 20,000 communities nationwide that are allowed to purchase federally backed flood insurance. This availability follows the community's adoption and enforcement of ordinances to reduce flood losses and acceptance by the National Flood Insurance Program (NFIP).

Zapata County is now a participant in the NFIP effective on December 7, 2006. Residents of Zapata County will be able to purchase flood insurance up to the limits under the Emergency Phase of the program. However, there is a 30-day waiting period before the flood insurance coverage goes into effect. For single-family dwellings, the building coverage limit is $35,000 and the contents coverage limit is $10,000. Renters can also protect the belongings by purchasing contents cove age limits are both $100,000. Higher lin its of coverage will be available after th initial Emergenc Phase.

Lenders must require borrowers wh properties are located in a designate flood hazard area to purchase flood insu ance as a condition of receiving a fede ally backed mortgage loan in accordanc with the Federal Disaster Protection A of 1973.

The NFIP is implemented through th Federal Emergency Managemer Agency. There are over four million floo insurance policies in more than 20,00 participating communities nationwide.

er

over milk in large containers. Anyone could bring a jug and fill it free. We drank lots of milk!

In spite of our limited diet, we all grew up pretty healthy probably because our diets included plenty of milk, fruits and vegetables. Those were the cheap foods that our limited finances couldn't afford. Most fatty meats were thus eliminated. I can't remember there being any fast-food restaurant around to eat at. Everywhere we went we

THE BATTLE OF THE BEANS

As we were raised on navy beans, we hadn't ever eaten pinto beans until years later when we came to Texas. Even then we completely ignored them. Like grits we knew that the pintos were a southern favorite, but we thought that navy beans were ŒIT), so we kept on 'cooking, them up' and 'eatin, them up'. After having pinto beans offered to us many times, we were finally persuaded

JOKE OF THE WEEK

Don't worry about tomorrow, today will probably do you in anyway.

E-mail address: ginger5338@juno.com

Happy Birthday

Vicky Chapa

February 16, 2007

With Love, Mike, Mikey, Sara, Bibi,

August 12, 2008

The Honorable Rosalva Guerra
Zapata County Judge
P.O. Box 99
Zapata, Texas 78076

Re: Flood Protection Planning Contract between the Texas Water Development Board (TWDB) and Zapata County (County), TWDB Contract No. 2003483490, Draft Final Report Comments

Dear Judge Guerra:

Staff members of the TWDB have completed a review of the draft report under TWDB Contract No. 20034830490. As stated in the above-referenced contract, the County will consider incorporating draft report comments, shown in Attachment 1, as well as other comments received, into the final report.

The TWDB looks forward to receiving one (1) electronic copy of the entire Final Report in Portable Document Format (pdf) and six (6) bound double-sided copies. The County should also submit one (1) electronic copy of any computer programs or models and an operation manual developed under the terms of this contract.

If you have any questions concerning this contract, please contact Gilbert Ward, the TWDB's designated Contract Manager for this study at (512) 463-6418.

Sincerely,

Carolyn L. Brittin
Deputy Executive Administrator
Water Resources Planning and Information

Enclosures

c: Gilbert Ward, TWDB

Attachment I

Review of Draft Report for Contract No. 2003-483-490
Zapata County Flood Protection Planning Study

1. Typographical errors, incomplete sentences and fragments occur throughout the report. Please edit and correct when the report is final.

2. The numbering of figures within the text for Part II – Hydrology Study is wrong starting with Figure 5 referenced on Part II, Page 5. Please correct. Also, the figure numbering convention between Part I and Part II is confusing with two figures having the same number in specific instances. Please change the numbering format to relieve the confusion.

3. There is a reference on Part II, Page 5 (2nd paragraph) to a Figure 5B which could not be located. Please provide in final report.

4. Point of Concentration information depicted on Figure 3 (of Part II) is difficult to discern. Please consider a different convention to make it easier to read.

5. The Soils Map (Figure 5 in Part I but Figure 4 in Part II) is not readable. Please consider a different scale or have a more legible copy made for the final.

6. In general, the study follows standard practice. However, the method used is dependent on the assumptions made by the evaluator. There was no information presented that the study was calibrated with a known event to confirm the assumed basin and storm attributes used in the study. Please provide model calibration information, or reasons why standard calibration analysis could not be performed.

6. Several problems have been noted with Part II, Page 5, 3rd paragraph. (A) The figure numbers referenced are the wrong numbers. Please correct. (B) The first sentence states that the culverts under SH 16 are "general" (typo) adequate to convey the 100-year storm, but then states that there is a potential traffic hazard. Please provide a description of what this "traffic hazard" is associated with (that is, is it flood related or something completely off subject). (C) Also, the Stream Profile figures seem to indicate that the SH 16 culverts are <u>not</u> adequate to convey the 100-year storm, with only one of the creeks indicated as not overtopping (or at least very near) the roadway. Could this sentence be referencing the 25-year storm rather than the 100-year event? Please reevaluate and/or correct. (D) It may be necessary to re-do the Stream Profile figures in order to more clearly portray these water surface elevations versus the top of road elevations (and/or add the top of road elevation to Table numbers 4, 5, 6, and 7). Please consider doing both for the final report for clarification. (E) The second sentence, the word "only" doesn't seem to fit here. Please correct. (F) Next to last sentence references a "Culvert 1" which does not appear on any figures, tables or prior references. Please describe or put on the appropriate figure to locate. (G) Also in these last sentences of this paragraph, a statement is made concerning the models not being calibrated but that the overtopping of the SH 16 compares to actual flooding during "record storms." Two things: (G1) this seems to be the first mention of model calibration (or lack of). Other than comparing results using different methodologies for the hydrologic analysis, there is no calibration of the model against actual data. If there is actual data from "record storms", please provide a calibration analysis of the methodology utilized by the study. If there is no available data to offer a calibration, please describe and amend the end of this paragraph. And (G2), if the model results are being compared to information obtained from public and/or County official's estimates during storm events, please amend the paragraph to reflect this information appropriately.

7. Section in Part II, "Flood Prevention and Flood Control Alternatives," figure numbers are incorrect. Please amend.

8. The section referenced in item 7 only describes structural alternatives. Earlier in the report under "Goals and Objectives" a statement was made that both structural solutions and non-structural solutions were considered by the study. Please describe the non-structural alternatives that the study reviewed, particularly since the County's application and scope of work indicated that non-structural alternatives would be considered by the analyses.

9. Under "Sources of Funding and Assistance," the description of funding assistance which could be provided by the TWDB is incorrect, or at best inaccurate. Flood control projects can be funded by low-interest loans through the Board, but should be separate from possible grants available from the Federal Emergency Management Agency (FEMA) mitigation programs which are administered by the Board. Information pertaining to the Board loans is presented in the report, but there are references to FEMA and grants which should not be presented in association with the loan information.

10. The report should also describe the public meetings which had been held during the course of the study. Please include this in the final report.

11. Mitigation alternatives identified by the study are eligible for funding under the Board's financial assistance programs. Application requirements and eligibility criteria is identified by Board rules specified in Section 363 of the Texas Administrative Code. The report would be appropriate for use in support of an application to the Board for financing the proposed improvements. All additional information required by Board rules, 31 TAC 363.401-404, as well as necessary information to make legal findings as required by Texas Water Code Chapter 17.771-776, would be required at the time of loan application.