Attachment 7

Economic Analysis – Flood Damage Reduction Cost Benefits

Introduction

The Lower Mission Creek Flood Control and Restoration Project was originally proposed by the United States Army Corps of Engineers (USACE) in coordination with the Santa Barbara County Flood Control and Water Conservation District, and the City of Santa Barbara (City). The USACE project intends to increase flood protection along Mission Creek by increasing the creek capacity from an estimated 8-year event to a 20-year event. This project also provides significant rehabilitation of the creek. Rehabilitation will improve water quality by increasing natural soils and plants for infiltration and treatment; and provide features to enhance the aquatic habitat such as fish ledges, rock weirs, composite revetment with joint plantings, and a more natural creek bottom.

Reach 2B Phase 1 is a portion of the overall Rehabilitation Project sponsored in part by the USACE. This phase of work will improve flood protection and restore the portion of lower Mission Creek spanning a distance of approximately 425 feet from the Union Pacific Railroad right-of-way upstream to the State Highway 101 right-of-way. This reach is in the center of Santa Barbara and will protect significant residential and commercial values. Without this project, lower Mission Creek would remain at an 8-year event protection level, exposing the City to a high level of risk. The benefits associated with the project are summarized below.

Costs

Annual Cost of Flood Damage Reduction (Table 10)

The construction costs for the initial phase of the Lower Mission Creek Flood Control and Restoration Project total $1,587,417 per 2010 price values. Since the project will be constructed in 2012, the project total cost is represented at the 6% update rate, applied over two years, equaling $1,783,622 as shown in Table 10 column (a). Annual administration, operation, maintenance, and replacement costs would total $3005 beginning in 2013. This is an estimated 5.93 percent of the total annual costs estimated for the entire set of reaches in the USACE 2004 Economic Analysis Report (Exhibit 7-A, Table E22) of $30,000, updated to 2013 costs using the 6 percent update rate. This adjustment is based on the fact that the proposed improvements in this phase make up approximately 5.93 percent of the total EAD benefits for all completed phases. The total present value of costs for this project over its useful life is $1,537,413.

Table 10- Annual Cost of Flood Damage Reduction Project

(All costs should be in 2009 Dollars)

Project: Lower Mission Creek Flood Control and Restoration Project- Reach 2B Phase 1

	Initial Costs	Operations and Maintenance Costs (1)						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
YEAR	Grand Total Cost From Table 6 (row (i), column(d)) Initial costs (updated to 2012 costs at start of construction)	Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +…+ (f)	Discount Factor	Discounted Costs(g) x (h)
2009							$0	1.000	$0
2010							$0	0.943	$0
2011							$0	0.890	$0
2012	$1,783,622						$1,783,622	0.840	$1,498,243
2013				$3,005			$3,005	0.792	$2,380
2014				$3,005			$3,005	0.747	$2,245
2015				$3,005			$3,005	0.705	$2,119
2016				$3,005			$3,005	0.665	$1,998
2017				$3,005			$3,005	0.627	$1,884
2018				$3,005			$3,005	0.592	$1,779
2019				$3,005			$3,005	0.558	$1,677
2020				$3,005			$3,005	0.527	$1,584
2021				$3,005			$3,005	0.497	$1,493
2022				$3,005			$3,005	0.469	$1,409
2023				$3,005			$3,005	0.442	$1,328
2024				$3,005			$3,005	0.417	$1,253
2025				$3,005			$3,005	0.394	$1,184
2026				$3,005			$3,005	0.371	$1,115
2027				$3,005			$3,005	0.350	$1,052
2028				$3,005			$3,005	0.330	$992
2029				$3,005			$3,005	0.312	$938
2030				$3,005			$3,005	0.294	$883
2031				$3,005			$3,005	0.278	$835
2032				$3,005			$3,005	0.262	$787
2033				$3,005			$3,005	0.247	$742
2034				$3,005			$3,005	0.233	$700
2035				$3,005			$3,005	0.220	$661
2036				$3,005			$3,005	0.207	$622
2037				$3,005			$3,005	0.196	$589
2038				$3,005			$3,005	0.185	$556
2039				$3,005			$3,005	0.174	$523
2040				$3,005			$3,005	0.164	$493
2041				$3,005			$3,005	0.155	$466
2042				$3,005			$3,005	0.146	$439
2043				$3,005			$3,005	0.138	$415
2044				$3,005			$3,005	0.130	$391
2045				$3,005			$3,005	0.123	$370
2046				$3,005			$3,005	0.116	$349
2047				$3,005			$3,005	0.109	$328
2048				$3,005			$3,005	0.103	$310
2049				$3,005			$3,005	0.097	$291
2050				$3,005			$3,005	0.092	$276
2051				$3,005			$3,005	0.087	$261
2052				$3,005			$3,005	0.082	$246
2053				$3,005			$3,005	0.077	$231
2054				$3,005			$3,005	0.073	$219
2055				$3,005			$3,005	0.069	$207
2056				$3,005			$3,005	0.065	$195
2057				$3,005			$3,005	0.060	$180
2058				$3,005			$3,005	0.058	$174
Project Life								…	
Total Present Value of Discounted Costs (Sum of Column (i))									$1,537,413
Transfer to Table 20, column (c), Exhibit F: Proposal Costs and Benefits Summaries									

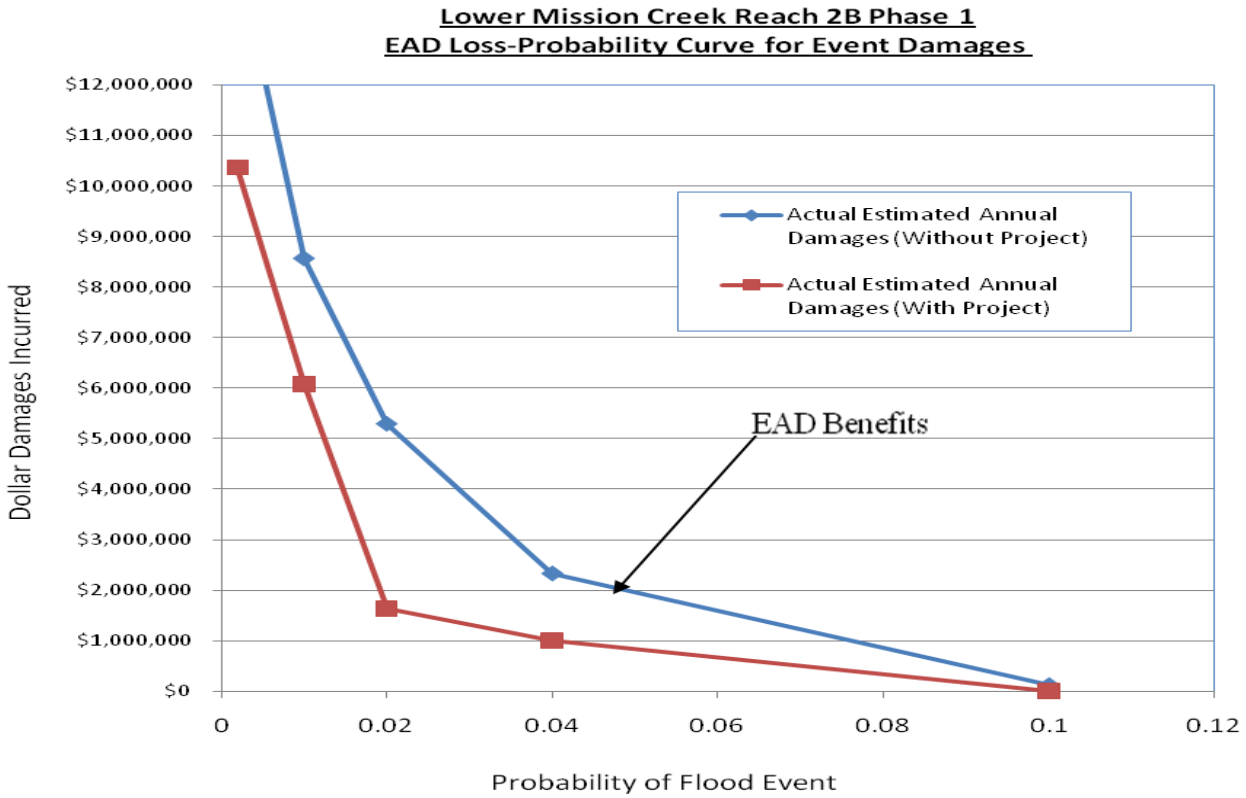
Event Damage and associated EAD (Tables 11a & 11b)

The Lower Mission Creek Reach 2B Phase 1 Project (Project) is located south of State Highway 101 in the affected areas labeled "Reach 4" and "Laguna Reach 2" in the USACE 2004 Economic Analysis, (Exhibit 7-A, Table E5 and map). The combined structure and content damages for “Reach 4” and “Laguna Reach 2” is $1,374,400 (2004$) per (Exhibit 7-A, Table E16). The Project comprises 1/5 of the total future reach improvements located below State Highway 101 (Reach 1A-1, 1A-2, 1B, 2A and 2B-1), thus equating to 1/5 of the structure and content damages, or $274,880 (1/5 x $1,374,400 in 2004$). The total structure and content damages in all affected areas is $4,636,800 (2004$) (Exhibit 7-A, Table E16). The Project area affected is therefore 5.93 percent (or $274,880/$4,636,800) of the total structure and content damages. 5.93 percent is applied to the Total Median Expected Structural and Content Damages (Exhibit 7-A, Table E17) for the 10-year through 500-year probability events, increased from 2004$ to 2009$ using the 6 percent update rate over five years (1.34 percent) and transferred to column (c) of Table 11a below.

“With Project” Probabilities for Structural Failure are derived from GIS analyses of flood inundation areas for pre-project and post-project flood events ranging from the 10-year to the 100-year events. The number of parcels inundated during pre-project events are given the probability of 1. The number of post-project affected parcels are divided by the number of pre-project affected parcels to obtain the "With Project" Probability of Structural Failure. Since post-project creek capacity occurs at the 20-year event flows, and since pre project creek capacity occurs at the 8-year event flows, the 10 year event, "Without Project" and "With Project" probabilities were valued at 1 and 0, respectively. Event Benefits are reflected in Table 11a, column (h) and in the graph below.

Table 11a - Event Damage (Lower Mission Creek Reach 2B Phase 1)

Hydrologic Event	Event Probability	Damage if Flood Structures Fail (2009 $)	Probability Structural Failure		Event Damage (2009 $)		Event Benefit (2009 $)
			Without Project	With Project	Without Project	With Project	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
					(c) x (d)	(c) x (e)	(f) – (g)
10-Year	0.1	$118,045	1	0	$118,045	$0	$118,045
25-Year	0.04	$2,327,540	1	0.43	$2,327,540	$1,000,842	$1,326,698
50-Year	0.02	$5,290,586	1	0.31	$5,290,586	$1,640,082	$3,650,505
100-Year	0.01	$8,563,442	1	0.71	$8,563,442	$6,080,043	$2,483,398
500-Year	0.002	$14,600,747	1	0.71	$14,600,747	$10,366,531	$4,234,217



Additional "Without Project" damages as listed in the 2004 USACE Economic Analysis include Emergency Cleanup Costs, Traffic Disruption Costs, Bank Stabilization Costs and FEMA-based Temporary Rental Assistance and Emergency Home Repairs (TRA) Costs (Exhibit 7-A, Table E21) as reflected in Table 11b below. The USACE Analysis lists these costs in EAD values. These EAD costs are increased to reflect 2009 price values using an update rate of 1.39% ($(1+0.06)^5$). Since the project is expected to have a channel that is stabilized by concrete or riprap, there is an expected zero cost for bank stabilization when the project is constructed. "With Project" costs are calculated using an average of the GIS-generated inundation ratios for hydrological events as listed in Table 11a, column (e).

Table 11b - Additional EAD (Lower Mission Creek Reach 2B Phase 1)

Description*	Event Damage (2009 $)		
	Without Project	With Project	Total Benefits
	(a)	(b)	(c)
Emergency/ Cleanup Costs	$10,327	$4,957	$5,370
Traffic Disruption Costs	$1,525	$732	$793
Bank Stabilization Costs**	$3,305	$0	$3,305
FEMA Temporary Rental Assistance and Emergency Home Repair (TRA) Costs	$1,366	$656	$711
Total	**$16,523**	**$6,345**	**$10,178**

Present Value of Expected Annual Damage Benefits (Table 12)

The present value of expected annual damage benefits is determined by integrating columns (f), (g) and (h) of Table 11a, adding the additional EAD costs of Table 11b, and updating to reflect the present value (2009$) over the 50-year design life of the project. The results are reflected in Table 12 below.

Table 12 - Present Value of Expected Annual Damage Benefits (2009$) Project: Lower Mission Creek Flood Control and Restoration Project - Reach 2B Phase 1			
(a)	Expected Annual Damage Without Project (1)		**$327,999**
(b)	Expected Annual Damage With Project (1)		**$167,166**
(c)	Expected Annual Damage Benefit	(a) – (b)	**$160,833**
(d)	Present Value Coefficient at 6% discount rate = $(1+i)^t = (1+0.06)^{50yrs}$		**18.42**
(e)	**Present Value of Future Benefits** **Transfer to column (e) Table 20: Proposal Costs and Benefits Summaries.**	**(c) x (d)**	**$2,962,536**

(1) This program assumes no population growth thus EAD will be constant over analysis period.

Exhibit 7-A

Lower Mission Creek USACE 2004 Economic Analysis

Exhibit 7-A

Los Angeles District

Lower Mission Creek

Economic Appendix

Economic & Social Analysis Section
November 2004

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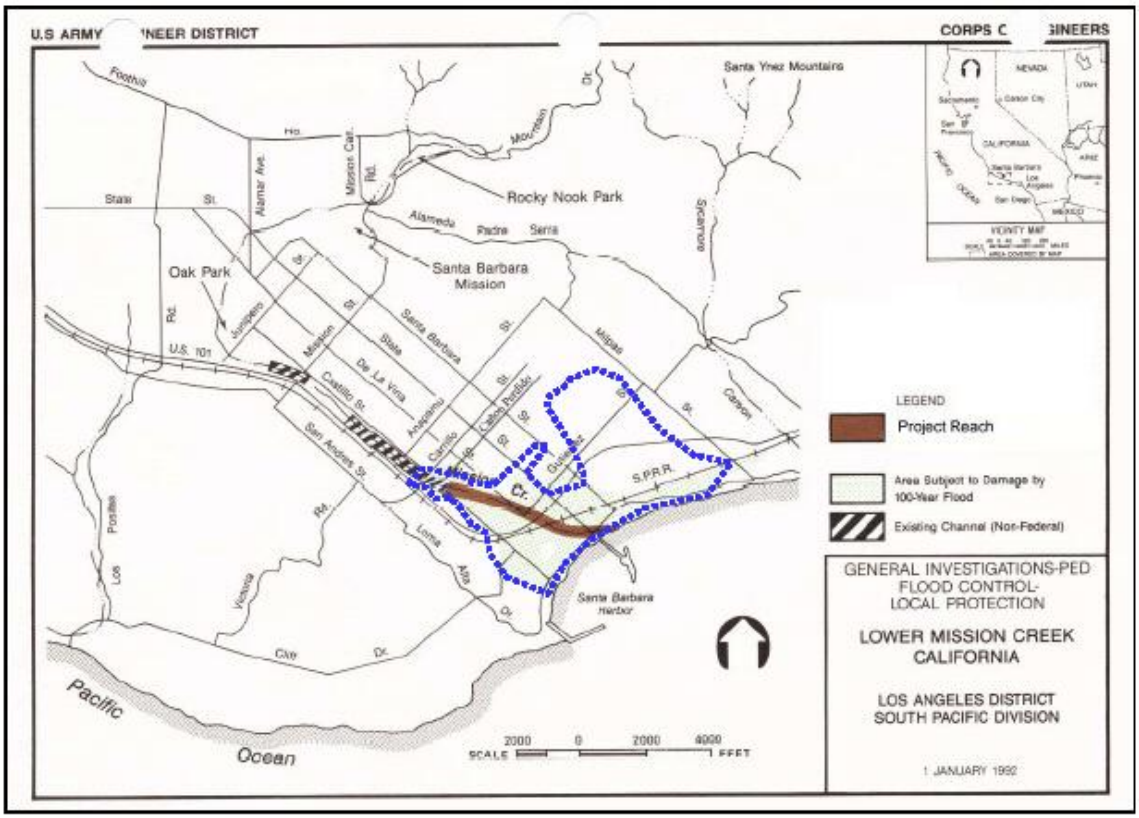
1 The Study

This economic appendix for Lower Mission Creek will re-evaluate the project benefits for a Post Authorization Change Report (PAC). Since the authorization in 2000, the project has undergone changes that caused the cost to increase above the limitation prescribed in Section 902 of WRDA 86. Congress authorized the project at an estimated cost of $18,300,000. The current revised cost estimate is $27,897,000 (FY 2004 price level), which exceeds the maximum allowable by $5,230,000. This report will review the changes in policies and methodologies that have occurred since the authorization of the original report in 1999.

A Study Area

The study area covers the drainage areas of Lower Mission Creek and Laguna Channel. Both drainage areas are located within the Santa Barbara city limits in southern Santa Barbara County. The 1999 Feasibility Report evaluated the drainage area of Mission Creek from Cannon Perdido Street (in the City of Santa Barbara) to the Pacific Ocean. Laguna Channel drainage is south of the Mission Creek drainage area and covers the area from De La Guerra Street to the Pacific Ocean. The economic evaluation for the PAC report will be based on the same study area. Figure E1 shows map of the study area.

Figure E1.



B Study Purpose and Scope

The purpose of the original feasibility report was to present an economic analysis that measured beneficial contributions to National Economic Development (NED) from the implementation of a flood control alternative within the Lower Mission Creek/Laguna Channel. The report recommended a plan that provided 20-year level protection or capacity of 3,400 cfs.

This evaluation will re-evaluate the damages and benefits of the original NED Plan that was identified in the 1999 evaluation. This new evaluation will review the changes in policies and methodologies that have occurred since 1999. Some of the changes in policies and methodologies that have occurred since 1999 include the following: construction of new buildings within the floodplain, development of residential and commercial depth-damage curves, increases in building costs (Marshall & Swift), and changes in FEMA overhead costs. Also, the report will present data from the original evaluation in 1999 to compare the changes between the two evaluations.

The scope of this economic assessment consists of re-evaluating the annual damages that are expected to occur in the Lower Mission Creek/Laguna Channel floodplain. Lower Mission Creek drains an 11.5 square mile area located in central and downtown Santa Barbara into the Pacific Ocean. Lower Mission Creek floods frequently, causing severe damage in residential, commercial, and industrial areas. The Laguna Channel drainage area was included in the economic assessment based on historical overflows of Lower Mission Creek flowing into its drainage basin.

C Historical Flood Damage

Historical flooding in Lower Mission Creek dates back to 1862. The most significant recent floods occurred successively in January and February of 1995. Table E1 lists the historical flood damages. The damages from the following flood events include damages to structures and contents. The update of historical damages from 1999 to 2004 was based on price indexes in the Civil Works Construction Cost Indexes System (CWCCIS).

Table E1
Lower Mission Creek
Historical Flood Damages
Source: City of Santa Barbara
2004 Price Levels

Flood Event	Damages	Annual Frequency
March, 1995	$6,168,000	9-year
January, 1995	$13,298,000	55-year
January, 1983	$2,078,000	10-year
February, 1978	$2,347,000	11-year
January, 1967	$4,417,000	NA

2 Demographics

A Socio-economic Profile

The city of Santa Barbara is located within Santa Barbara County, 80 miles north of Los Angeles. Santa Barbara is located along the South Coast Highway 101 and is bordered on its western side by the Pacific Ocean. The community is convenient to Los Angeles and other coastal cities along the Pacific Ocean in Southern California.

B Population

Approximately 60-percent of Californians are living in Southern California, a distribution that has not changed significantly in the past four decades. In addition, almost 75-precent of Californians live in the coastal regions, with the inland dwelling proportion increasing steadily over the past 3 decades

As a result of the recession in the early 1990s, the population of California experienced a massive emigration and the slowest recorded population growth for any decade. The domestic migration exodus consisted mainly of people leaving Southern California (Los Angeles, Orange, and Ventura Counties). Santa Barbara County, however, has still managed to grow from 369,000 in 1990 to 399,347 in 2000.

The population of Santa Barbara County in 2000 comprised 1.25-precent of the population of California; the county population was 399,347 and the State population was 33,871,648. As shown in Table E2, the county experienced a net population increase of almost 8-percent between 1990 and 2000. This rate of growth is slightly below the rate for California has a whole 8.2-percent during the same period. Using the U.S. Bureau of Economic Analysis projection data for the State of California, the state is expected to experience a population increase of more than 28-precent by 2025, a considerable faster rate of growth than the United States at 23%-percent.

The City of Santa Barbara has experienced a net increase of over 6,754 people since 1990, an increase of 9.3-percent. The median age of the population of Santa Barbara is

34.6 years. Santa Barbara County's median age is 33.4 years, and the median age for California is 33.6 years. Santa Barbara County has a population of 50,765 of people over the age of 65, which is 12.7-percent of the population.

Using 2000 Census reports, the population of the City of Santa Barbara is 77-percent Caucasian. Minority populations include: Asian (2.9%), American Indian and Alaskan Native (1.1%), African American (1.8%), Native Hawaiian (0.1%); and Other (17%). Approximately 35-percent of the population is of Hispanic or Latino heritage. There are 35,605 households and the average household size is 2.47 persons.

Table E2
Lower Mission Creek
Comparative Population Data (1980-2025)

	1980	1990	2000	2025
Santa Barbara	74,414	85,571	92,325	101,067
Santa Barbara County	298,694	369,608	399,347	576,448
California	23,667,764	29,760,021	33,871,648	43,601,763
United States	226,549,000	248,709,873	281,421,906	344,683,537

C Employment

Table E3 indicates the predominant sectors of employment for residents of the study area, according to the Profile of Selected Economic Characteristics: 2000, recently published by the U.S. Census Bureau. As shown in the table, the service industry is important in all regions associated with the study area. The service industries include: information; professional, scientific, management, administrative, and waste management services; educational, health and social services; arts, entertainment, recreation, accommodation and foodservices; public administration; and other services.

In 2002, the value of agricultural production was $775.1 million. This ranks the county 13th in the state of California. Leading agricultural commodities include strawberries, broccoli, wine grapes, head lettuce, and cauliflower.

In Santa Barbara County, the unemployment rate in 2002 was 4.2-percent up from 3.5-percent in 2001. The city of Santa Barbara has a rate of 3.9-percent, a little lower than the county rate and much lower than California, which is 6.7-percent.

Table E3
Lower Mission Creek
Employment by Industry, (2000)

Industry	Santa Barbara	Santa Barbara County	California
Industry Total	505,705	179,900	14,718,928
Farming & Mining	282	15,300	282,717
Construction	3,138	8,000	915,023
Manufacturing	5,036	13,400	1,930,141
Wholesale & Retail Trade	7,056	24,600	2,237,552
Transportation & Warehousing, & Utilities	3,816	28,100	689,387
Finance, Insurance & Real Estate	19,521	44,500	1,016,916
Services	8,910	25,400	7,647,192

D Income

Table E4 summarizes pertinent information regarding income and effective buying power by household in the study area. Services are the largest growth industry in Santa Barbara County, accounting for 18.9-percent growth since 1999. Retail trade is second at 11.4-percent, and government is 9.6-percent. The civilian labor force has increased to 206,600, and increase of 1.5-precent since 1998. Government, trade, transportation and utilities, and leisure and hospitality are the largest industries in the county. The Government is the largest employer, providing 35,600 jobs, almost 20-percent of all employment. The trade, transportation and utilities industries provides 15.6-percent of all employment, over 72-percent are in retail trade. Slightly more than 14-percent of the county population was living below the poverty level in 2001. The median income of households in Santa Barbara County was $46,677. Eighty percent of the households received earnings and 16-percent received retirement income other than Social Security. Twenty-five percent of the households received Social Security. The average income from Social Security was $13,153. As shown in Table E4, the per capita income is lower, and the median household income in the study area is higher than figures for the county and state.

Table E4
Lower Mission Creek
Income Levels by Household, (2000)

Income Distribution	Santa Barbara	Santa Barbara County	California
Total Housholds	36,317	136,769	11,512,020
Less than $15,000	4,479	18,268	1,615,869
$15,000-$24,999	3,561	15,498	1,318,246
$25,000-$34,999	3,744	16,968	1,315,085
$35,000-$49,999	5,674	21,754	1,745,961
$50,000-74,999	6,819	26,510	2,202,873
$75,000 or more	12,040	37,771	3,313,986
Median Household Income	$52,570	$46,667	$47,493
Per Capita Income	$28,732	$23,059	$22,711

E Transportation

There are 346,994 vehicles registered in Santa Barbara County alone. In 2003, the county had over 1,668 miles of streets, roads, and highways. Major interstate highways servicing the county include the U.S. Highway 101, Highway 1 (running from Pismo beach down to Gaviota). The mean travel time to work in the county is approximately 16.7 minutes, and 66-percent of the workers drive alone. The county has an airport in Santa Barbara that has a few major carriers, but services mostly commuter flights. Santa Barbara County has an Amtrak Station that is located in Santa Barbara. The station is served daily by *Coast Starlight* trains to and from Los Angeles, Oregon and Washington, and Amtrak California's *Pacific Surfliners* to and from San Diego and Los Angeles. Other trains extend north to San Luis Obispo. While Amtrak Motor Coach services *San Joaquin* and some *Pacific Surfliners* trains.

3 Methodology

A Guidance and Regulation

This economic assessment is formulated to be in accordance with ER 1105-2-100. Further, benefits and costs expressed as annual values are calculated utilizing the FY04 discount rate of 5 5/8 percent with a project life of fifty-years. All benefits are costs are expressed at 2004 price level. In addition, this report will display the economic analysis that was completed for the WRDA 2000 submission. The WRDA 2000 analysis was based on a discount rate of 6 5/8 percent and price level of 1999.

B Computer-based Models and Reference Sources

The following items were utilized for the economic assessment of Lower Mission Creek and Laguna Channel.

Models:

(1) HEC's Flood Damage Reduction Analysis (HEC-FDA)
(2) HEC's Expected Annual Damage (EAD) model

References:

(1) Marshall & Swift Evaluation Services
(2) Depth Damage Relationships - Expert Panel Meeting, Houma, Louisiana, January 22, 1997
(3) EGM 04-01, Generic Depth-Damage Relationships for Residential Structures
(4) First American Real Estate Database

C Database Field Survey

The original field survey was conducted in 1997 and was based on 100% field survey. The survey recorded the following items: relative First Floor Elevation (FFE), structure type, structure condition, and structure use. Another field survey was conducted in February of 2004. The purpose of the most recent survey in 2004 was to verify any changes to residential and commercial development in the floodplain.

D Topographic Mapping

The Lower Mission Creek floodplain was topographically mapped at a 2-foot contour interval. This mapping and field survey FFEs were combined to estimate absolute FFE.

E Reach Delineation

Economics, Hydrology, and Hydraulics study members participated in the segmenting of the Lower Mission Creek and the Laguna Channel study area into six major reaches of homogenous characteristics. Reaches 1 through 4 in the Lower Mission Creek study area were segmented into sub-reaches to differentiate characteristics within these major reaches. Critical factors for differentiation included: discharge/frequency characteristics, overflow spatial characteristics, and economic activity.

Table E5
Lower Mission Creek
Reaches

Reach Name	Sub-reach Name	Creek Bank	Reach Location
Reach 1	Rch 1 Left	East	From the creek to De La Vina St. and Bradbury Ave.
	Rch 1 LL	East	East of De La Vina St. and Bradbury Ave. to Anacapa St.
	Rch 1 Right	West	From the creek to U.S. Highway 101
Reach 2	Rch 2 Left	East	From the creek to Brinkoff Ave.
	Rch 2 LL	East	East of Brinkoff Avenue to Santa Barbara St.
	Rch 2 Right	West	From the creek to U.S. Highway 101
Reach 3	Rch 3 Left	East	From the creek to Brinkoff Ave.
	Rch 3 LL	East	From the creek to Brinkoff Ave.
	Rch 3 Right	West	From the creek to U.S. Highway 101
Reach 4	Rch 4 Left	East	From the creek to Laguna Drainage Channel
	Rch 4 Left X	East	From the creek to Laguna Drainage Channel
	Rch 4 Right	West	From the creek to Burton Circle
	Rch 4 Right X	West	From the creek to Los Aquajes
	Rch 4 Right XX	West	From the creek to Castillo Street
	Rch 4 RRE	West	West of Burton Circle to Castillo St.
	Rch 4 RRW	West	West of Burton to Santa Barbara City College
Laguan Reach 1	NA	NA	North of Highway 101
Laguna Reach 2	NA	NA	South of Highway 101

4 Without Project Conditions

A Floodplain Inventory

A site survey of the floodplain was conducted in 1997 and 2004 to estimate the structures depreciated replacement value. The structure values were based on information provided by Santa Barbara County's Clerk-Recorder Assessor Office, construction costs from Marshall & Swift, and two site surveys were conducted in 1997 and 2004. Table E6 shows the depreciated replacement values for structures in 1999 and 2004. Table E7 shows the content values for the structures in 1999 and 2004.

The 2004 commercial structure content values are based on either an expert panel that was conducted in Houma, Louisiana (1997) or survey of commercial structures in the Lower Mission Creek Floodplain (1997). A 1997 commercial content survey was able to verify the content to structure ratio for retail stores, auto related businesses, light industrial businesses, and warehouses. For the other businesses, the best available information was used, which was the expert panel that was conducted in Houma, Louisiana (1997). The Houma depth-damage relationships were developed from an expert panel meeting (e.g., of Corps of Engineers Economist, Engineers, outside consultants, FEMA, etc.) that was conducted in Houma, Louisiana. Also, the Houma ratios are significant less than ratios used in the 1999 report. The commercial content to structure ratios are listed in Table E8.

The content to structure ratios for residential structures are based on 1997 survey of residential structures. The survey estimated the residential content to structure value to be 64.3-percent.

Table E6
Lower Mission Creek
Total Structure Value and Average Value

	Number of Structures	Structure Value 1999 Price Level	Structure Value 2004 Price Level	Average Value 2004 Price Level
Comm	569	$212,983,000	$239,291,000	$421,000
MFR	312	$52,125,000	$62,316,000	$200,000
Public	35	$35,068,000	$48,513,000	$1,386,000
SFR	225	$12,858,000	$14,706,000	$65,000
Total	1141	$313,034,000	$364,826,000	$320,000

Table E7
Lower Mission Creek
Total Content Value and Average Value

	Number of Structures	Content Value 1999 Price Level	Content Value 2004 Price Level	Average Value 2004 Price Level
Comm	569	$282,220,000	$101,294,000	$178,000
MFR	312	$52,125,000	$27,052,000	$120,000
Public	35	$28,567,000	$63,029,000	$280,000
SFR	225	$8,229,000	$9,456,000	$42,000
Total	1141	$371,141,000	$200,831,000	$176,000

Table E8
Lower Mission Creek
Content Value to Structure Value Ratio

	Content Value to Structure Value Ratio WRDA 2000	Content Value to Structure Value Ratio FY2004
Retail	111%	111%
Auto Related Businesses	120%	120%
Light Industrial Buildings	214%	214%
Warehouses	215%	215%
Restaurants	100%	40%
Public Buildings	25%	37%
Hotels	100%	22%
Apartment Buildings	55%	22%
Office Buildings	100%	91%

B Without Project Damages

The annualized damages to structures (e.g., damages to buildings and contents) are calculated using the HEC-FDA computer program. The model computes annual damages based upon the following input parameters:

1.) Structure data, including structure I.D., category (single-family residences, multi-family residence, public, commercial, industrial), stream location, ground elevation, first floor elevation, and structure value. This data was

developed in a spreadsheet, converted into a text file and imported into the HEC-FDA program.

2.) The calculations of content and structure damages are based on only the base year, since the watershed development is build-out.

3.) The 1999 evaluation determined that the depth/damage relationships provided by FEMA provided the best available information for the Lower Mission Creek Floodplain. Table E9 shows the FEMA depth-damage curves.

4.) Since the 1999 report was completed, U.S Army Corps of Engineers developed generic depth-damage relationships for residential structures. The 2004 evaluation used the depth-damage relationships from EGM 04-01 for calculating damages to residential structures. The residential depth-damage relationships are listed in Table E10. For non-residential structures, the 2004 evaluation used depth-damage relationships that were developed from an expert panel meeting (e.g., of Corps of Engineers Economist, Engineers, outside consultants, FEMA, etc.) that was conducted in Houma, Louisiana. Table E10 shows the non-residential depth-damage curves used in the 2004 report. The damage relationships for non-residential are applied based on the type of construction.

Table E9
Lower Mission Creek
1997 FEMA Depth-Damage Curves

Depth (ft)	Damage to Structures (percent)	Damage to Contents in Residential Structures (percent)	Damage to Contents in Commercial Structures (percent)
-1	0%	0%	0%
0	9%	12%	11%
1	16%	24%	18%
2	25%	33%	24%
3	28%	35%	29%
4	30%	37%	35%
5	31%	41%	40%
6	40%	45%	45%
7	43%	50%	50%
8	43%	57%	55%
9	45%	60%	60%
10	46%	60%	60%

Table E10
Lower Mission Creek
Structure Depth-Damage Curves

	IWR Residential Struct.		Houma Non-residential Structures	
Depths	Damage to Structures (Percent)	Standard Error	Damage to Wood-Frame Structures (percent)	Damage to Masonary Structures (percent)
-1	3%	3%	0%	0%
0	13%	2%	1%	2%
0.5	19%	2%	18%	12%
1	23%	2%	18%	12%
1.5	28%	2%	24%	17%
2	32%	2%	27%	17%
3	40%	2%	31%	22%
4	47%	2%	37%	26%
5	53%	2%	45%	29%
6	59%	2%	45%	30%
7	63%	2%	46%	30%
8	67%	2%	48%	32%
9	71%	2%	52%	42%
10	73%	3%	52%	48%

4) The 2004 evaluation used the guidance in EGM 04-01 to calculate content damage for residential structures. The content depth-damage relationships are based on percentage of structure value instead of the value of contents. Table E11 shows the residential depth-damage relationships for residential content damages for the 2004 evaluation

5) The calculation of content damages for non-residential structures in the 2004 evaluation used the depth-damage relationships that were developed from an expert panel in Houma, Louisiana. The depth-damage relationships were based on a percentage of the structure value. Table E8 shows the content value-to-structure value ratio for different types of structures. The depth-damage relationships for non-residential structures used in the 2004 evaluation in calculating content damages are listed in Table E12.

Table E11
Lower Mission Creek
IWR Generic Depth-Damage Relationships
Residential Structures - Content Damages

Depth (ft)	Damage to Contents in Residential Structures (percent)	Standard Error
-1	2.4%	2.1%
0	8.1%	1.5%
1	13.3%	1.2%
2	17.9%	1.2%
3	22.0%	1.4%
4	25.7%	1.5%
5	28.8%	1.6%
6	31.5%	1.6%
7	33.8%	1.7%
8	35.7%	1.8%
9	37.2%	1.9%
10	38.4%	2.1%

Table E12
Lower Mission Creek
Houma Non-Residential Depth-Damage Relationships
Contents

Depths	Restaurant	Auto Related	Hotels and Apartments	Office Bldgs.	PublicBldgs	Retail	Warehouse and Industrial
-1	0%	0%	0%	0%	0%	0%	0%
-0.5	0%	0%	0%	0%	0%	0%	0%
0	0%	0%	0%	0%	0%	0%	0%
0.5	18%	9%	8%	13%	36%	11%	8%
1	24%	27%	15%	16%	65%	23%	12%
1.5	45%	69%	18%	29%	65%	33%	16%
2	48%	79%	22%	34%	65%	55%	20%
3	77%	87%	38%	65%	90%	69%	27%
4	91%	90%	43%	80%	100%	77%	31%
5	94%	96%	45%	82%	100%	86%	39%
6	94%	96%	45%	90%	100%	94%	46%
7	97%	96%	45%	92%	100%	94%	53%
8	97%	96%	45%	92%	100%	94%	61%
9	97%	96%	45%	92%	100%	94%	68%
10	97%	96%	53%	92%	100%	97%	73%

6) The 2004 evaluation included no changes to the hydrologic and hydraulic data that was used in the 1999 evaluation. The Engineering Division provided the hydrologic and hydraulic data. Also, the data was imported into HEC-FDA program.

7) The 2004 evaluation employed the levee function of the HEC-FDA model to represent flooding conditions within the floodplain. Under this construction, inundation damages are prevented from occurring and flood stages are contained within the channel. For each of the reaches the levee was based on

the estimated elevation of the creek banks. Table E13 lists the elevation of the banks and its corresponding probability event of overtopping the creeks' banks.

8) The HEC-FDA model computes expected annual damages using a Monte Carlo simulation process. The resultant includes the expected annual damages in the study area.

Table E13
Lower Mission Creek
W/O Exceedance Probability Event by Reach

Reach Name	Elevation of the Creek Bank (ft)	Without Project Conditions
Rch 1 LL	33.7	70-yr
Rch 1 Left	34.6	7-yr
Rch 1 Right	38.6	14-yr
Rch 2 LL	26.2	50-yr
Rch 2 Left	28.6	10-yr
Rch 2 Right	28.6	10-yr
Rch 3 LL	24.5	50-yr
Rch 3 Left	24.5	16-yr
Rch 3 Right	24	16-yr
Rch 4 Left	12.2	5-yr
Rch 4 Left X	12.2	5-yr
Rch 4 Right	12.2	5-yr
Rch 4 Right X	15.8	25-yr
Rch 4 Right XX	12.2	5-yr
Rch 4 RRE	17.1	25-yr
Rch 4 RRW	17.5	40-yr
Rch Lag 1	8.5	10-yr
Rch Lag 2	8.5	10-yr

C Risk & Uncertainty Modeling

The two variables subject to R&U variations for the economic determination of stage/damage functions are First Floor Elevation (FFE) and Depreciated Replacement Cost (DRC). For estimating the uncertainty of the FFE, the study team used a normal distribution with a mean of 0 and a standard deviation of .6 feet (based upon guidance contained in EM 1110-2-1619). For DRC uncertainty, a triangular distribution was used for the different types of structures. The mean value for the uncertainty function was based on the estimated value of the structure. The lower and higher limits for the triangular function were based on lower and higher classifications listed in Marshall & Swift. Table E14 lists the lower and higher limits for different types of structures.

Also, the depth damage relationships for residential buildings include a standard error of the percent damages for each depths of flooding. Table E10 and E11 show the standard error for structures and contents respectively.

Table E14
Lower Mission Creek
Triangular Distribution of the Depreciation Replacement Structure Values
The Percentage Change in the Median Value to the Lower and Higher Limit Values

Occ. #	Description	Lower Limit %Change	Higher Limit %Change
1	Single Family (1 Floor)	10.6%	10.6%
2	Single Family (2 Floors)	10.6%	10.6%
11	Duplex (1 Floor)	9.8%	8.6%
12	Duplex (2 Floors)	9.8%	8.6%
13	Duplex (3 Floors)	9.8%	8.6%
14	Apartment (1 Floor)	9.8%	8.6%
15	Apartment (2 Floors)	9.8%	8.6%
16	Apartment (3 Floors)	17.3%	15.1%
17	Apartment (4 Floors)	17.3%	15.1%
18	Hotel (1 Floor)	13.4%	29.3%
19	Hotel (2 Floors)	13.4%	29.3%
20	Hotel (3 Floors)	13.4%	29.3%
21	Hotel (4 Floors)	13.4%	29.3%
111	Retail (1 Floor)	22.5%	22.2%
112	Retail (2 Floors)	22.5%	22.2%
113	Auto Sales-Repair	21.8%	26.6%
114	Office Building (1 Floor)	24.5%	25.5%
115	Office Building (2 Floors)	24.5%	25.5%
116	Office Building (3 Floors)	24.5%	25.5%
117	Office Building (4 Floors)	24.5%	25.5%
118	Light Industrial Building	22.7%	25.5%
119	Warehouse	23.5%	27.1%
120	Restaurant	24.7%	24.5%
1111	Government Buildings	21.6%	24.5%
1112	Churches	20.2%	21.0%
1113	Utilities	18.4%	24.4%
1114	Social Clubs	25.9%	27.2%
1115	Schools	18.6%	18.4%

D R&U Hydrology/Hydraulic Variable Parameters

The hydrologic engineering relationships allowed by the HEC-FDA model to fluctuate are the frequency/discharge function and the stage/discharge function. For the frequency/discharge relationship, the model used the graphical approach to compute a statistical distribution of the possible discharges. This statistical distribution was based upon the data contained in the water surface profiles and the equivalent record lengths that were estimated for each reach. For the reaches located in the Lower Mission Creek floodplain had an equivalent record length of 27. The reaches in Laguna Channel floodplain had an equivalent record length of 15. The Engineering Division provided the data. For the stage/discharge relationship, a normal distribution is assumed for the uncertainty data. The data included standard errors for the 10-year, 25-year, 50-year, and 100-year event. Table E15 shows the standard errors for each of the reaches.

Table E15
Lower Mission Creek
W/O Standard Error of Water Surface Elevation

Reach Name	Index Location	10-year	25-year	50-year	100-year	500-year
Rch 1 L	5115	0.10	0.31	0.64	0.94	0.94
Rch 1 LL	4370	0.00	0.00	0.00	0.90	0.90
Rch 1 R	5115	0.10	0.31	0.64	0.94	0.94
Rch 2 L	4370	0.09	0.27	0.57	0.93	0.93
Rch 2 LL	3002	0.00	0.00	0.42	0.90	0.90
Rch 2 R	4370	0.09	0.27	0.57	0.93	0.93
Rch 3 L	2842	0.25	0.53	0.88	0.94	0.94
Rch 3 LL	2842	0.00	0.00	0.33	0.90	0.90
Rch 3 R	3842	0.25	0.53	0.88	0.94	0.94
Rch 4 L	1765	0.10	0.29	0.67	0.92	0.92
Rch 4 R	1765	0.10	0.29	0.67	0.92	0.92
Rch 4 RRE	1510	0.00	0.00	0.35	0.90	0.90
Rch 4 RRW	1510	0.00	0.00	0.27	0.90	0.90
Rch lag 1	1000	0.00	0.48	0.66	0.90	0.90
Rch lag 2	1680	0.00	0.10	0.70	0.90	0.90

E Structure and Content Damages

Table E16 shows the total structure and content damages calculated by the HEC-FDA program for the 1999 evaluation and 2004 evaluation. Table E17 lists the median value of damages for each probability event.

Table E16
Lower Mission Creek
Without Project Damages
"(000)

	Without Project Damages 1999 Price Level	Without Project Damages 2004 Price Level
Reach 1	$193.7	$294.3
Reach 2	$407.5	$584.7
Reach 3	$74.1	$116.5
Reach 4	$1,209.4	$1,303.7
Reach Lag 1	$1,744.8	$2,266.9
Reach Lag 2	$87.1	$70.7
Total	$3,716.6	$4,636.8

Table E17
Lower Mission Creek
Median Expected Structural and Content Damages
For Probability Events
'(000)

Stream	10-year	25-year	50-year	100-year	500-year
Lower Mission Creek	$1,400	$14,200	$31,000	$53,100	$105,000
Laguna Channel	$86	$15,100	$35,600	$54,700	$78,800
Total Median Damages	$1,486	$29,300	$66,600	$107,800	$183,800

F Bank Stabilization Costs

The channel capacity of Lower Mission Creek depends on the stability of the creek banks. It is expected that erosion will threaten the creek's banks. Santa Barbara Flood Control Agency is responsible with rebuilding the creek's bank. The agency will spend an average of $41,600 (37,500,1999 price level) per year to maintain the banks.

5 Nonstructural Damages

A Emergency/Cleanup Costs

Emergency/cleanup costs include losses and above physical flood damages which result from the disruption of normal activities. Emergency costs include those costs that would not otherwise be incurred except for flooding. These costs include evacuation and re-occupation of the floodplain, flood fighting, disaster relief and increases in normal operations of police, fire, medical, governmental and industry activity. Clean-up costs include the costs of removing and disposing sediment that covered the streets, parking lots, and public property.

Calculation of emergency/cleanup costs in the Lower Mission Creek Floodplain is based on conversations with city officials responsible for flood fighting efforts and the cleanup efforts after the flooding occurred in 1995. Separate storm events in 1995 were estimated to be about a 55-year and a 9-year storm event. The EAD analysis for both the Lower Mission Creek floodplain and Laguna Drainage calculated the annual damages for emergency/cleanup to be $130,000 ($118,400,1999 price level).

Table E18
Lower Mission Creek
Emergency and Cleanup Costs
'(000)

Frequency	1999 Price Level	2004 Price Level
9-year	$240	$266
55-year	$1,438	$1,596
100-year	$2,065	$2,292
500-year	$3,740	$4,151
EAD	$118	$130

B FEMA- Temporary Rental Assistance/Emergency Home Repairs

FEMA provides grants to assist individuals and families to find suitable housing when they are displaced in cases of federally declared disasters. This assistance being directly attributable to the disaster and being an expenditure that would not be undertaken except for the disaster falls clearly under the emergency costs guidance of ER1105-2-100. Therefore, funds expended by FEMA for Temporary Rental Assistance (TRA) or Funds for Minor Emergency Home Repairs (FMEHR) in the event of flooding are NED flood damages.

Complying with ER 1105-2-100, an Internet database search of FEMA disaster reports for flood and storm damage was performed. Table E19 shows a compilation of the various FEMA reports related to flood and storm.

Table E19 shows the average per claim expenditure by FEMA for TRA ranged from $583 to $2,034 with an overall average expenditure of $1,537 per claim. The standard deviation of the average per claim expenditures is $411.

For risk-based modeling purposes it is assumed that TRA per claim expenditure is normally distributed with a mean of $1,537 and a standard deviation of $411. The mean of $1,537 was applied as other value to each residential structure (single family and multiple family residences) in the HEC-FDA model. The HEC-FDA calculated the TRA for the without project conditions to be $17,200.

Table E19
Lower Mission Creek
TRA Average Expenditure

	Date	Temporary Rental Assistance	TRA Claims	$ per Claim
Addrew, Iron etc.,MO	Apr-99	$328,233	341	$963
Kansas	Jan-99	$3,380,199	2388	$1,415
Kansas & Missouri	Oct-98	$3,335,504	3762	$887
South, Central and Southeast Texas	Oct-98	$28,047,095	13786	$2,034
Southeast Texas	Sep-98	$4,190,165	2159	$1,941
Southwest Texas	Aug-98	$2,156,601	1445	$1,492
Wisconsin	Aug-98	$7,000,173	5221	$1,341
St. Louis City & County, MO	Jul-98	$1,300,000	2231	$583
Massachusetts	Jun-98	$5,400,000	3527	$1,531
Oregon	Jun-98	$215,294	132	$1,631
North Carolina	Jan-98	$1,213,285	703	$1,726
California	1998	$22,000,000	15000	$1,467
Georgia	1998	$3,100,000	2455	$1,263
Totals		$81,666,549	53150	$1,537

C Transportation Loss

Flooding in the Lower Mission/Laguna Channel drainage area has impeded automobiles and the railroad traffic within the City of Santa Barbara. Even the threat of flooding and concern for public safety may make it necessary to detour traffic. The transportation losses are determined by calculating the additional operating cost by taking alternative routes and the traffic costs per passenger.

The calculations of transportation losses are based upon the technical guidance of Institute of Water Resources Report 1-R-12, " Value of Time Saved for Use of Corps Planning Studies: Review of the Literature and Recommendations."

The expected transportation losses by event in the Lower Mission Creek/Laguna Channel are listed in Table E20. The expected annual transportation losses totaled $19,200

Table E20
Lower Mission Creek
Expected Transporation Losses
'(000)

Drainage Area	25-year	50-year	100-year	500-year
Cost of Time of Delay for Traffic	$95	$180	$256	$1,510
Cost of Mileage for Traffic	$31	$54	$65	$100
Total Traffic Losses	$127	$234	$321	$1,610
Railroad Losses (Amtrak)	$0	$24	$24	$32
Total Losses	$127	$258	$345	$1,643

6. Summary of Without Project Damages

The expected annual damages in the Lower Mission Creek/Laguna Channel Floodplain are shown in Table E21.

Table E21
Lower Mission Creek
Without Project Expected Annual Damages Summary
FY 2004 Price Level
'(000)

Type	Damages
Structural/Contents Inundation (Lower Mission Creek)	$2,299.2
Structural/Contents Inundation (Laguna Channel)	$2,337.6
Emergency/Clean-up	$130.0
Traffic Disruption	$19.2
Bank Stabilization	$41.6
TRA	$17.2
Total	$4,844.8

7 With Project Analysis

In 1999, the feasibility study identified the most cost-effective means of providing flood protection in the study area. The plan that is most cost-effective is the plan that maximizes contributions to National Economic Development (NED) minus the cost to implement the plan or the net benefits. The plan selected will provide 20-year level of protection and have a channel capacity of 3,400 cfs.

A NED Alternative: 3,400 cfs. Capacity with Oxbow Bypass – Stabilized sides combination vertical wall and riprap.

This alternative will increase the channel capacity to 3,400 cfs and would provide approximately a 20-year level of protection. Natural bottom will be maintained and creek

banks would consist of combination vertical wall and riprap. The bottom half of the bank will consist of vertical walls while the upper half will be built with riprap at a 1.5:1(H:V) slope. The riprap would be covered with topsoil while concrete pipes in varying sizes (up to a maximum of three feet in diameter) will be strategically placed in between the riprap to allow planting of native coastal trees and vegetation.

Upstream of Highway 101, the combination riprap-vertical wall will be the predominant bank treatment, except in two short reaches just upstream of Haley-De La Vina Bridge and De La Guerra Bridge. Below Highway 101, the combination vertical wall and riprap will be applied along the southeast bank, starting from midway between Chapala Bridge and Mason Bridge to State Street, and along the middle third of the southwest bank between Mason Street and State Street. Vertical walls will be maintained for the remainder of this reach. The improved creek would generally follow the existing alignment and will incorporate a new culvert between Highway 101 and Chapala Street Bridge that will bypass the oxbow. The oxbow will be left in place functioning as the flow channel. Four bridges along the study reach would be replaced including Ortega Street, Cota Street, De la Vina Street, and Mason Street Bridge.

B Annual Cost for NED Plan –2004 Evaluation

The construction cost for NED Plan will be amortized over the 50-year project life. Project cost includes Interest During Construction (IDC) and operation and maintenance cost. A summary of the project costs for the NED Plan is listed in Table E22. Also, Table E22 includes the annual cost calculated for the 1999 evaluation.

Table E22
Lower Mission Creek
Project Costs for NED Alternative
Price Level = 2004

Cost Description	NED Plan Costs
Real Estate	$6,582,200
Removal and Relocation	$663,800
Bridge Construction	$3,156,300
Channels Construction	$10,794,700
PED	$2,425,100
Construction Management	$1,171,300
Contingency	$3,103,600
Subtotal Costs	$27,897,000
Total IDC	$1,516,700
Total Gross Investment	$29,413,700
Total Annual Costs	$1,769,200
Annual OMRR&R Costs	$30,000
2004 Total Annual Costs	$1,799,200
1999 Total Annual Costs	$1,367,000

C Structural Damages for the With Project Conditions

With Project Damages – The evaluation of 3,400 cfs alternatives

The methodology used in calculating the damages for the without project condition was applied to the evaluation of damages for the NED Plan. The model evaluated the annual damages for the 3,400 cfs channel based on the following input parameters:

1.) The economic information for 3,400 cfs alternatives is the same economic information that was used in calculating the without project damages, except for structures that are expected to be demolished. Table E25 lists the structures that are expected to be demolished with the NED Plan.
2.) Hydrology and Hydraulics Sections provided water surface profiles for all reaches. Based these water surface profiles; the calculation of the frequency/discharge and stage/discharge relationships were computed for all the reaches.
3.) This analysis employed the levee function of the model to represent flooding conditions within floodplain. The levee function prevents damages occurring when the water elevation is lower than height of the bank. For each of the reaches the levee was based on the estimated water elevation of the creeks banks. Table E23 lists the elevation of the levee and its corresponding probability event of overtopping. The NED Plan is expected to provide 20-year level of protection. However, some of the reaches provide significant higher-level of protection than 20-year level of protection. In addition, the evaluation of the 20-year level of protection excludes Laguna Channel from the evaluation, since it was based on the frequency of flooding on Lower Mission Creek.

Table E23
Lower Mission Creek
With Project Conditions
Exceedance Probability Event by Reach

Reach Name	Elevation of the Non-Damaging (ft)	With Project Conditions
Rch 1 LL	34	250-yr
Rch 1 Left	40.3	23-yr
Rch 1 Right	40.3	23-yr
Rch 2 LL	26.3	90-yr
Rch 2 Left	28.5	50-yr
Rch 2 Right	28.5	50-yr
Rch 3 LL	24.3	100-yr
Rch 3 Left	24.3	50-yr
Rch 3 Right	25.7	50-yr
Rch 4 Left	14.4	50-yr
Rch 4 Left X	14.4	50-yr
Rch 4 Right	13.1	26-yr
Rch 4 Right X	16	100-yr
Rch 4 Right XX	13.7	35-yr
Rch 4 RRE	17.4	82-yr
Rch 4 RRW	17.5	90-yr
Rch Lag 1	8.5	14-yr
Rch Lag 2	8.5	11-yr

4) The without project parameters for risk and uncertainty were used for the evaluation of 3,400 cfs alternatives, except for the standard error relating to the stage/discharge relationships. The standard errors for the with project condition: 10-year, 25-year, 50-year, and 100-year frequencies. Table E24 shows the calculated standard errors for the each of the reaches.

Table E24
Lower Missin Creek
Standard Error of Water Surface Elevation
With Project Conditions

Reach Name	Index	10-year	25-year	50-year	100-year	500-year
Rch 1 L	5115	0.10	0.34	0.71	0.97	0.97
Rch 1 LL	4370	0.00	0.00	0.00	0.00	0.90
Rch 1 R	5115	0.11	0.34	0.71	0.97	0.97
Rch 2 L	4370	0.10	0.32	0.68	0.94	0.94
Rch 2 LL	3002	0.00	0.00	0.00	0.90	0.90
Rch 2 R	4370	0.10	0.32	0.68	0.94	0.94
Rch 3 L	2842	0.30	0.65	0.92	0.95	0.95
Rch 3 LL	2842	0.00	0.00	0.00	0.90	0.90
Rch 3 R	3842	0.30	0.65	0.92	0.95	0.95
Rch 4 L	1765	0.14	0.39	0.69	0.92	0.92
Rch 4 R	1765	0.14	0.39	0.69	0.92	0.92
Rch 4 RRE	1510	0.00	0.00	0.00	0.90	0.90
Rch 4 RRW	1510	0.00	0.00	0.00	0.90	0.90
Rch lag 1	1000	0.00	0.48	0.66	0.90	0.90
Rch lag 2	1680	0.00	0.09	0.30	0.90	0.90

5) The description of the alternatives includes a wider channel than current channel. Table E25 lists the properties that will be eliminated due to the construction of a wider channel. The cost to demolish the structures is included in the real estate cost estimate in Table E22. Since the structures are removed, the value of the structures is equal to zero. The value of the structure and contents were deleted from the structure database.

Table E25
Lower Mission Creek
Structures Removed from the Floodplain

Structure Address	No. of Stuct	Type	Reach
326 W. De la Guerra St.	1	Residential	Reach 1 R
303 W. Ortega St.	1	Residential	Reach 1 L
633 Bath St	2	Residential	Reach 1 L
631 Bath St	3	Residential	Reach 1 L
434 De la Vina St.	1	Residential	Reach 2 R
15 W. Mason	1	Commercial	Reach 4 L

6) The evaluation of the NED Plan was completed, after all the parameters and data were inputted into the HEC-FDA program. Table E26 (1999) and E27 (2004) show the total average damages and benefits for the NED Plan.

Table E26
Annual Benefits for NED Plan (1999)
Structure and Content Damages
1999 Price Level
"(000)

	Without Project Damages 1999	With Project Damages 1999	Total Benefits 1999
Reach 1	$193.7	$100.0	$93.7
Reach 2	$407.5	$252.8	$154.7
Reach 3	$74.1	$45.4	$28.7
Reach 4	$1,209.4	$614.6	$594.8
Reach Lag 1	$1,744.8	$1,291.8	$453.0
Reach Lag 2	$87.1	$45.5	$41.6
Total	$3,716.6	$2,350.1	$1,366.5

Table E27
Annual Benefits for NED Plan (2004)
Structure and Content Damages
2004 Price Level
"(000)

	Without Project Damages 2004	With Project Damages 2004	Total Benefits 2004
Reach 1	$294.3	$159.5	$134.8
Reach 2	$584.7	$367.4	$217.3
Reach 3	$116.5	$75.2	$41.3
Reach 4	$1,303.7	$649.9	$653.8
Reach Lag 1	$2,266.9	$1,621.6	$645.3
Reach Lag 2	$70.7	$36.7	$34.0
Total	$4,636.8	$2,910.3	$1,726.5

D Reduction of the Bank Stabilization Costs

Since the NED Plan is expected to have a channel that is stabilized by concrete or riprap, each alternative is expected to have zero cost for bank stabilization. The annual benefit from the reduction in bank stabilization costs is $41,600.

E Reduction in Emergency and Clean-up Damages

The NED Plan is expected to reduce the frequency of flooding in the floodplain. The costs relating to evacuation, disaster relief and the clean-up of sediment will be reduced due to reduction in the frequency of flooding. Based on the reduction of frequency of flooding the EAD program calculated a reduction in the cost of the clean-up costs and emergency costs. The NED Plan is expected to reduce the annual damages from emergency/clean-up damages from $130,000 to $51,400. The total benefit from the reduction in emergency/clean-up damages is $78,600.

F Reduction in FEMA-Temporary Rental Assistance TRA costs

The implementation of the NED Plan is expected to reduce TRA costs for residential structures in the floodplain. Also, the parameter of $1,537 per residential structure was used in the HEC-FDA model for calculating the TRA damages. The average annual TRA damage amount occurring after implementation of the NED Plan is $13,400. Since the without project condition is $17,200, the TRA is net annual benefit is $3,800.

G Reduction in Transportation Losses – With Project

Based on the maps from the Hydrology & Hydraulics Branch, showing the reduction in the time duration of flooding with the implementation of the NED plan, it is expected that transportation losses will be reduce. The expected transportation losses by event for the Lower Mission Creek/Laguna Channel are listed in Table E28. The expected annual transportation losses totaled $15,200. Since the without project losses equal 19,200, the total annual benefits for the project is $4,000.

Table E28
Lower Mission Creek
Expected Transporation Losses
With Project Conditions

Drainage Area	25-year	50-year	100-year	500-year
Cost of Time of Delay for Traffic	$64	$120	$219	$1,412
Cost of Mileage for Traffic	$21	$37	$56	$93
Total Traffic Losses	$85	$157	$275	$1,505
Railroad Losses (Amtrak)	$0	$24	$24	$32
Total Losses	$85	$182	$299	$1,538

H Savings in Flood Insurance Overhead

The flood insurance costs that can be saved by alleviating a flood threat are the overhead and administrative cost of processing applications and operating the National Flood Insurance Program. Computer Sciences Corporation provided a list of all the FEMA policyholders within the Lower Mission Creek and Laguna Channel 100-year floodplain. The number of policies that are within the without project conditions 100-year floodplain is 237 policies. Based on the implementation of the NED Plan the size of the 100-year floodplain will be reduced, causing the number of policies in the 100-year flood plan to be 174. By implementing the NED Plan, it expected that 63 policies would not be needed. The current overhead cost per policy in 2004 is $161 per policy. The NED Plan will provide annual benefit of $10,100 by reducing the administrative cost of FEMA policyholders.

I Advance Bridge Replacement Benefit

The proposed alternatives include the construction of new bridges. The expected lives of the replacement bridges are expected to be greater than that of the existing structures, thereby extending the service life of the bridges. Since the total cost of the new bridge is included in the first cost of the project, a credit for this extension is calculated for the benefit side. A credit is also calculated for the reduction in O&M costs that will occur during the remaining life of the existing facility. A detail list showing the remaining life of bridges, maintenance cost of old bridge, life expectancy of new bridge, future annual maintenance cost, cost of the new bridge, annual maintenance benefits, and annual bridge replacement benefits is listed in Table E29.

The advance bridge replacement benefit for the De la Vina Street Bridge was based on the incremental cost for enlarging the bridge's conveyance. The estimated reduction in annual maintenance cost for the new bridge at De la Vina Street was not included in the benefit analysis.

Table E29
Lower Mission Creek
Advance Bridge Replacement

Bridge	Remaining life	Annual Maint Cost	Life Expectancy (New Bridge)	Future Maint	Bridge Cost	Annual Maint Benefit	Bride Replace Benefit
Mason St.	7	$1,500	50	$250	$108,000	$1,250	$42,900
Ortega St.	7	$7,500	50	$250	$757,900	$7,250	$23,800
Cota St.	7	$5,000	50	$250	$770,500	$4,750	$30,100
De la Vina St.	7	$5,000	50	$250	$598,100	$0	$30,500
Total Benefits						$13,250	$127,300

8 Benefits and Costs of NED Plan

After completing a re-evaluation of the original NED Plan authorized in WRDA 2000, the NED Plan has over $278,000 in net benefits and benefit/cost ratio of 1.15. The construction costs for the NED Plan have increased over 50-percent since the project was authorized in 2000. However, the higher costs for the project have been moderated by a 1-percent drop in discount rate. The lower discount rate reduces the annual cost for the construction costs and IDC costs.

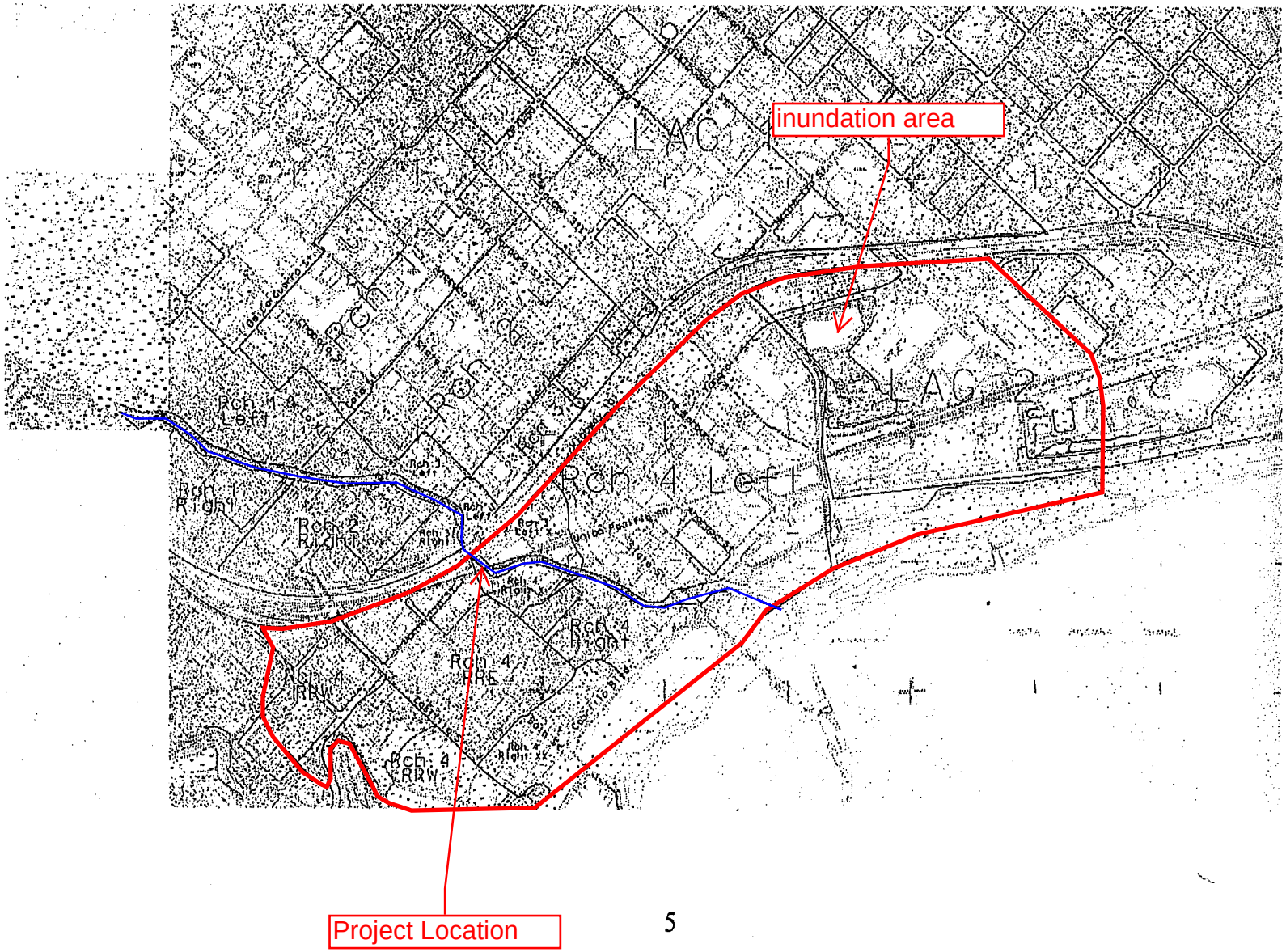
The annual benefits for the NED Plan have greatly increased since WRDA 2000, due to increases in building costs, changes in the depth damage relationships, and the higher costs for bridges. First, the building costs in the region have increased over 7-percent in last year. Secondly, the use of the new depth damage relationships for residential and non-residential structures have provided some of the increases in the annual benefits due to the reduction in content and structure damages. Finally, the higher advanced bridge replacement benefit is due to higher cost estimates for the new bridges.

Table E30 provides a comparison of the benefit and cost analysis for the 2004 and 1999 evaluation. Based on the current information for benefits and cost for the NED Plan, it is expected that the project will provide positive net benefits into the future.

Table E30
Lower Mission Creek
Annual Benefits and Costs
National Economic Development Account
Data in (000)

Project Benefits and Costs Red of Struct & Content Damages	NED Plan 2004 Price Level	NED Plan 1999 Price Level
Commercial	$1,422	$1,176
Multi-Family	$252	$108
Public	$67	$53
Single Family	$57	$30
Total Reduction of Damages	$1,798	$1,367
Advance Bridge Replacement	$127	$88
Red Bridge Maint	$13	$13
Red. Clean-up/Emergency	$79	$75
Red. FEMA Overhead	$10	$8
Red. TRA	$4	NA
Red. Bank Stabilization	$42	$37
Red. Transportation Losses	$4	$4
Total Annual Benefits	$2,077	$1,592
Annualized Investment Cost	1769	1337
Annual OMRR&R	$30	$30
Total Annual Cost for Project	$1,799	$1,367
Net Benefits	$278	$225
Benefit/Cost Ratio	1.15	1.16

Figure 1.


inundation area
Rch 4 Left
Rch 4 Right
Rch 4 RRW
Rch 4 RRE
Rch 1 Left
Rch 1 Right
Rch 2 Right
Rch 2 Left
LAG 1
LAG 2
Project Location