

# Woodbridge River, New Jersey, Flood Control and Ecosystem Restoration Study

## ECONOMICS APPENDIX

### INTRODUCTION

#### Purpose

This appendix presents the economic analysis used in the determination of the economic viability for federal participation in the Harrison, New Jersey Flood Control and Ecosystem Restoration study.

#### Benefit Types

Benefits to be derived from the plan of improvement include:

1. Reduced inundation damage to structures and contents
2. Reduced public emergency costs, cleanup costs, landscaping, and lost income.

#### Conditions

This appendix presents a description of the method used to develop damages and benefit-to-cost ratios, and is in accordance to ER 1105-2-100. Benefits and costs are expressed as average annual values at the current Federal discount rate of 5-3/8% and at October 2004 price levels for a 50-year period of analysis.

### DESCRIPTION OF STUDY AREA

The Township of Woodbridge is a 27-square mile municipality located in the northeastern part of Middlesex County. The most populated municipality in Middlesex County, Woodbridge is the oldest original township in the state and remained relatively small until the Garden State Parkway was built in the 1950s. Woodbridge Township, with a population of 97,203<sup>1</sup>, is New Jersey's fifth largest municipality. The Township consists of ten communities - Avenel, Colonia, Fords, Hopelawn, Iselin, Keasbey, Menlo Park Terrace, Port Reading, Sewaren, and Woodbridge proper.

#### Transportation

At the intersection of the Garden State Parkway and the New Jersey Turnpike, Woodbridge is one of New Jersey's major crossroads. The Amtrak Boston-Washington line and New Jersey transit's New York-Philadelphia train line meet at its Metropark station. Routes 1 and 9 join up just north of the 1.5 million square foot Woodbridge

---

<sup>1</sup> US Census Bureau, 2000



Center mall on Route 1. Routes 9, 440 and the Garden State Parkway meet at the southern tip of the township.<sup>2</sup>

### Woodbridge Township Demographic Profile

Woodbridge Township's population has increased by over 7 percent between 1980 and 2000.

Geographic Area	1980	1990	2000	Change, 1980-2000	
				Number	Percent
Woodbridge Township	90,074	93,092	97,203	7,129	7.9%
Middlesex County	595,893	671,810	750,162	154,269	25.9%
State of New Jersey	7,365,011	7,748,634	8,414,350	1,049,339	14.2%

*Source: US Bureau of Census*

Table 2 provides a breakdown by industries of the civilian labor force that reside in the Woodbridge Township as it compares to Middlesex County.

Industry	Woodbridge Township		Middlesex County	
	Number	Percent	Number	Percent
Agriculture, forestry, fishing and hunting, and mining	98	0.2	441	0.1
Construction	2,122	4.5	16,784	4.5
Manufacturing	5,761	12.2	50,728	13.7
Wholesale trade	2,280	4.8	17,900	4.8
Retail trade	5,975	12.6	41,175	11.1
Transportation and warehousing, and utilities	4,093	8.6	24,672	6.7
Information	2,189	4.6	19,426	5.2
Finance, insurance, real estate, and rental and leasing	4,167	8.8	35,229	9.5
Professional, scientific, management, administrative, and waste management services	6,203	13.1	48,150	13.0
Educational, health and social services	7,798	16.5	68,930	18.6
Arts, entertainment, recreation, accommodation and food services	2,605	5.5	20,289	5.5
Other services (except public administration)	2,127	4.5	14,004	3.8
Public administration	1,945	4.1	13,049	3.5
Total	47,363	100	370,777	100

*Source: U.S. Bureau of the Census*

<sup>2</sup> New York Times, real estate section, August 25, 2002



Table 3 shows that in 1999, Woodbridge Township's per capita income was \$25,087, which was below the County average of \$26,535, and the State's average of \$27,006.

TABLE 3. INCOME IN 1999						
	Woodbridge Township		Middlesex County		New Jersey	
	Number	Percent	Number	Percent	Number	Percent
<b>Households</b>	<b>34,529</b>	<b>100</b>	<b>265,898</b>	<b>100</b>	<b>3,065,774</b>	<b>100</b>
Less than \$10,000	1,588	4.6	13,102	4.9	213,939	7
\$10,000 to \$14,999	1,254	3.6	9,965	3.7	143,783	4.7
\$15,000 to \$24,999	2,665	7.7	20,603	7.7	288,606	9.4
\$25,000 to \$34,999	3,115	9.0	24,398	9.2	305,449	10
\$35,000 to \$49,999	4,952	14.3	37,097	14.0	437,373	14.3
\$50,000 to \$74,999	8,081	23.4	57,308	21.6	608,244	19.8
\$75,000 to \$99,999	5,695	16.5	42,599	16.0	413,928	13.5
\$100,000 to \$149,999	5,202	15.1	40,544	15.2	391,123	12.8
\$150,000 to \$199,999	1,240	3.6	11,823	4.4	130,492	4.3
\$200,000 or more	737	2.1	8,459	3.2	132,837	4.3
Median household income (dollars)	60,683	(X)	61,446	(X)	55,146	(X)
<b>Families</b>	<b>25,547</b>	<b>100</b>	<b>192,321</b>	<b>100</b>	<b>2,167,577</b>	<b>100</b>
Less than \$10,000	550	2.2	5,122	9.1	88,844	4.1
\$10,000 to \$14,999	415	1.6	3,644	5.6	58,500	2.7
\$15,000 to \$24,999	1,388	5.4	10,667	11.9	156,939	7.2
\$25,000 to \$34,999	1,955	7.7	15,223	12.9	189,840	8.8
\$35,000 to \$49,999	3,558	13.9	25,171	16.6	293,442	13.5
\$50,000 to \$74,999	6,515	25.5	43,601	19.1	463,743	21.4
\$75,000 to \$99,999	4,847	19.0	35,365	11	342,115	15.8
\$100,000 to \$149,999	4,576	17.9	35,311	9.1	340,376	15.7
\$150,000 to \$199,999	1,071	4.2	10,660	2.6	115,666	5.3
\$200,000 or more	672	2.6	7,557	2.2	118,112	5.4
Median family income (dollars)	68,492	(X)	70,749	(X)	65,370	(X)
Per Capita Income (dollars)	25,087	(x)	26,535	(x)	27,006	(X)
Source: U.S. Bureau of the Census						

## DESCRIPTION OF THE PROBLEM

During past floods, flooding was known to cover the Crampton Avenue neighborhood. Flooding in this area is characterized as a recurring problem caused by tidal surges in conjunction with storm water runoff. There are approximately 134 homes within the 100-year floodplain. The Ideal Mobile Home Community on Rahway Avenue consists of approximately 189 manufactured homes within a low-lying area of the Woodbridge River 100-year tidal floodplain.



## WITHOUT PROJECT FUTURE CONDITIONS

The most probable future for the flood-prone area within the river basin assumes a stable level of development. Local floodplain management ordinances ensure that future development will be outside the 100-year floodplain.

## FLOOD DAMAGE

### General

The analysis of flood damage utilized the following steps:

- Inventory flood plain development
- Estimate depreciated replacement costs
- Assign damage functions
- Assign ground elevations
- Calculate aggregate stage vs. damage relationships

### Inventory Method

The following assumptions were made because a complete structural inventory of the study area was not performed. These assumptions were made based on a walk through of the study area during a site visit:

Rahway Avenue Ideal Mobile Home Community Area: Manufactured home values were estimated based on the *Marshall & Swift Residential Cost Handbook*; the depreciated replacement for each manufactured home was estimated to be \$21,900 (Oct. 2004 P.L.). The content value was assessed as 65%<sup>3</sup> of the structural value, \$14,200 (Oct. 2004 P.L.). The Main Floor Elevation (MFE) is estimated to be 2.5 feet above ground.

Crampton Avenue Area: It was assumed that all structures are Cape Cods and having the following dimensions, 1.5 stories with a building footprint of 937.5 square feet. The depreciated replacement value of a Cape Cod was estimated using the *RS Means Square Foot Costs Manual*; each structure was estimated to be \$123,400 (Oct. 2004 P.L.). The content value was assessed as 36%<sup>4</sup> of the structural value, \$44,400 (Oct. 2004 P.L.). The following economic analysis calculated damages under four scenarios: 2 feet MFE, 3 feet MFE, 4 feet MFE, and 5 feet MFE.

The structure data was obtained through an on-site survey of the area using topographic mapping with a scale of 1 inch = 200 feet with 2-foot contour line intervals. The inventory was limited to categorizing structures by type, main floor elevation, and identifying the depreciated structure value. Residential structure values were calculated based on RS Means Square Foot Costs manual. There are approximately 300 residential

---

<sup>3</sup> Based on Passaic River Basin depth damage curves.

<sup>4</sup> Ibid.



structures within the 100-year floodplain. The data was entered into a Microsoft Excel spreadsheet to calculate the average annual damages.

The manufactured homes shown in Figure 1 are representative of the structures within Rahway Avenue Ideal Mobile Home Community. The Cape Cod structures shown in Figure 2 are representative of the residential structures located within the Crampton Avenue area.



Figure 1



Figure 2

### Description of Depth Damage Curves

The depth damage curves used for this analysis were based on the functions used in the 1996 GDM for Preservation of Natural Flood Storage-Passaic River Flood Damage Reduction Project study. The Passaic River Basin depth damage curves were based on over 3,500 interviews and an inventory of over 50,000 structures in the Passaic River Basin floodplain. A separate depth damage curve was developed for each type of residential structure category: bi-level, cape, colonial, ranch, split level, mobile home, two-family, and other (multiple dwelling, duplex, custom, bungalow, raised ranch). Table 4 shows the depth-damage relationships for cape cods and manufactured homes in one-foot increments. The “other” damage category includes the following: lawn damage, outbuildings, preparation and flood flight, evacuation and reoccupation, extra housing cost, lost income, and cleanup cost.



Depth	Cape Cod			Manufactured Home		
	Structure	Content	Other	Structure	Content	Other
-8	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
-7	0.4%	0.9%	0.2%	0.0%	0.0%	0.0%
-6	0.9%	2.2%	0.4%	0.0%	0.0%	0.0%
-5	1.2%	2.8%	0.7%	0.0%	0.0%	0.0%
-4	1.5%	3.1%	1.1%	0.0%	0.0%	0.0%
-3	1.9%	3.9%	1.7%	0.0%	0.0%	0.0%
-2	3.4%	7.0%	3.1%	0.0%	0.0%	0.0%
-1	5.3%	10.4%	4.9%	0.0%	0.0%	5.9%
0	6.5%	11.5%	7.2%	0.0%	0.0%	11.9%
1	20.2%	28.8%	9.3%	38.6%	26.6%	26.7%
2	21.1%	44.7%	11.1%	42.2%	53.2%	30.5%
3	22.8%	51.6%	12.1%	59.2%	62.4%	34.1%
4	24.4%	58.5%	13.1%	76.2%	71.5%	37.7%
5	26.1%	65.4%	14.0%	93.2%	80.6%	41.3%
6	27.6%	65.6%	14.6%	93.2%	80.6%	42.6%
7	29.2%	65.9%	15.1%	93.2%	80.6%	43.8%
8	30.8%	66.1%	15.6%	93.2%	80.6%	45.1%
9	32.4%	66.3%	16.1%	93.2%	80.6%	46.4%
10	33.9%	70.0%	16.6%	93.2%	80.6%	46.8%
11	35.5%	73.7%	17.1%	93.2%	80.6%	47.2%
12	37.1%	77.4%	17.6%	93.2%	80.6%	47.5%
13	38.6%	81.0%	18.0%	93.2%	80.6%	47.9%
14	40.2%	84.7%	18.5%	93.2%	80.6%	48.2%
15	41.8%	88.4%	19.0%	93.2%	80.6%	48.6%

### Stage Frequency Curves

The depth damage curves combined with the stage frequency curves shown in Table 5 and 6 enables the derivation of stage damage curves for the calculation of average damages for each storm event.

Storm Event	Water Surface Elevation in feet (NGVD)
2 Yr.	5.08
5 Yr.	6.78
10 Yr.	7.58
25 Yr.	9.3
50 Yr.	10.67
100 Yr.	11.85
200 Yr.	13.12
500 Yr.	14.74

Storm Event	Water Surface Elevation in feet (NGVD)
2 Yr.	5.19
5 Yr.	5.87
10 Yr.	6.27
25 Yr.	6.67
50 Yr.	6.9
100 Yr.	7.24
200 Yr.	13.12
500 Yr.	14.74



## Average Annual Damages

The storm damages were broken into three categories: structural damage, content damage, and other damage. Damages were calculated as a percent of structural value over a range of water depths from -8 feet below main floor level to +15 feet above main floor level for each flood stage.

Table 7 summarizes the without-project average annual damages for structural, content and other damages for the manufactured homes in the Ideal Mobile Home Park Community.

<b>TABLE 7. WOODBRIDGE, NJ                      AVERAGE ANNUAL STORM DAMAGE                      WITHOUT-PROJECT CONDITIONS Oct. 2004 P.L.                      MANUFACTURED HOME MFE 2.5ft.</b>						
<b>STORM EVENT</b>	<b>PROBABILITY</b>	<b>DIFFERENCE IN PROBABILITIES</b>	<b>DAMAGES</b>	<b>AVERAGE OF DAMAGES</b>	<b>AVERAGE ANNUAL DAMAGE INTERVAL</b>	<b>SUMMATION</b>
~	0.0%		\$6,814,087		\$13,628	\$120,577
		0.2%		\$6,814,087		
500	0.2%		\$6,814,087		\$17,669	\$106,948
		0.3%		\$5,889,582		
200	0.5%		\$4,965,076		\$21,297	\$89,280
		0.5%		\$4,259,458		
100	1.0%		\$3,553,840		\$30,347	\$67,982
		1.0%		\$3,034,730		
50	2.0%		\$2,515,620		\$28,276	\$37,635
		2.0%		\$1,413,796		
25	4.0%		\$311,971		\$9,359	\$9,359
		6.0%		\$155,986		
10	10.0%		\$0		\$0	\$0
		10.0%		\$0		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			

Tables 8 through 11 summarize the without-project average annual damages for structural, content and other damages for cape cod structures in the Crampton Avenue neighborhood. The average annual damages were calculated for structures with main floor elevations of 2 feet, 3 feet, 4 feet, and 5 feet.



**TABLE 8. WOODBRIDGE, NJ  
AVERAGE ANNUAL STORM DAMAGE  
WITHOUT-PROJECT CONDITIONS Oct. 2004 P.L.  
Cape Cod MFE 2ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$12,266,664		\$24,533	\$264,086
		0.2%		\$12,266,664		
500	0.2%		\$12,266,664		\$31,102	\$239,553
		0.3%		\$10,367,228		
200	0.5%		\$8,467,792		\$34,717	\$208,451
		0.5%		\$6,943,444		
100	1.0%		\$5,419,096		\$43,795	\$173,734
		1.0%		\$4,379,503		
50	2.0%		\$3,339,911		\$48,762	\$129,939
		2.0%		\$2,438,106		
25	4.0%		\$1,536,301		\$56,241	\$81,177
		6.0%		\$937,352		
10	10.0%		\$338,404		\$18,924	\$24,936
		10.0%		\$189,240		
5	20.0%		\$40,077		\$6,012	\$6,012
		30.0%		\$20,038		
2	50.0%		\$0			

**TABLE 9. WOODBRIDGE, NJ  
AVERAGE ANNUAL STORM DAMAGE  
WITHOUT-PROJECT CONDITIONS Oct. 2004 P.L.  
Cape Cod MFE 3ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$9,814,462		\$19,629	\$182,955
		0.2%		\$9,814,462		
500	0.2%		\$9,814,462		\$24,606	\$163,326
		0.3%		\$8,201,862		
200	0.5%		\$6,589,262		\$26,153	\$138,720
		0.5%		\$5,230,592		
100	1.0%		\$3,871,922		\$29,894	\$112,567
		1.0%		\$2,989,397		
50	2.0%		\$2,106,873		\$31,181	\$82,673
		2.0%		\$1,559,055		
25	4.0%		\$1,011,236		\$36,472	\$51,492
		6.0%		\$607,866		
10	10.0%		\$204,496		\$11,424	\$15,020
		10.0%		\$114,237		
5	20.0%		\$23,977		\$3,597	\$3,597
		30.0%		\$11,988		
2	50.0%		\$0			



**TABLE 10. WOODBRIDGE, NJ  
AVERAGE ANNUAL STORM DAMAGE  
WITHOUT-PROJECT CONDITIONS Oct. 2004 P.L.  
Cape Cod MFE 4ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$7,836,171		\$15,672	\$124,560
		0.2%		\$7,836,171		
500	0.2%		\$7,836,171		\$19,023	\$108,888
		0.3%		\$6,340,984		
200	0.5%		\$4,845,797		\$18,241	\$89,865
		0.5%		\$3,648,211		
100	1.0%		\$2,450,625		\$18,925	\$71,624
		1.0%		\$1,892,524		
50	2.0%		\$1,334,423		\$19,763	\$52,699
		2.0%		\$988,162		
25	4.0%		\$641,901		\$23,224	\$32,936
		6.0%		\$387,060		
10	10.0%		\$132,219		\$7,386	\$9,712
		10.0%		\$73,862		
5	20.0%		\$15,505		\$2,326	\$2,326
		30.0%		\$7,753		
2	50.0%		\$0			

**TABLE 11. WOODBRIDGE, NJ  
AVERAGE ANNUAL STORM DAMAGE  
WITHOUT-PROJECT CONDITIONS Oct. 2004 P.L.  
Cape Cod MFE 5ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$6,016,570		\$12,033	\$83,638
		0.2%		\$6,016,570		
500	0.2%		\$6,016,570		\$13,719	\$71,605
		0.3%		\$4,573,105		
200	0.5%		\$3,129,639		\$11,669	\$57,885
		0.5%		\$2,333,894		
100	1.0%		\$1,538,149		\$12,001	\$46,216
		1.0%		\$1,200,096		
50	2.0%		\$862,043		\$12,741	\$34,215
		2.0%		\$637,057		
25	4.0%		\$412,072		\$15,000	\$21,474
		6.0%		\$250,001		
10	10.0%		\$87,931		\$4,916	\$6,474
		10.0%		\$49,158		
5	20.0%		\$10,385		\$1,558	\$1,558
		30.0%		\$5,193		
2	50.0%		\$0			



## **COSTS AND BENEFITS OF ALTERNATIVES**

The initial screening of flood damage reduction alternatives resulted in the following structural and nonstructural alternatives:

### **Alternative 1:** Ideal Mobile Home Park and Crampton Avenue Neighborhood Nonstructural Protection

This alternative would involve non-structural protection for approximately 189 homes in the Ideal Mobile Home Park, and 110 homes in the Crampton Avenue neighborhood. The nonstructural measure analyzed was to raise the mobile homes in Ideal Mobile Home Park and the homes in the Crampton Avenue neighborhood for structures located within the 100-year floodplain.

### **Alternative 2:** Ideal Mobile Home Park Nonstructural Protection and Crampton Avenue Neighborhood Floodwall System

Approximately 110 homes in the Ideal Mobile Home Community would have non-structural measures applied to them. The nonstructural measure analyzed was to raise the mobile homes in Ideal Mobile Home Park for structures located within the 100-year floodplain. The other part of this alternative consists of an approximately 4,200 foot-long floodwall placed around the Crampton Avenue neighborhood with an elevation of 12 feet NGVD above existing.

### **Alternative 3:** Crampton Avenue Neighborhood and Ideal Mobile Home Park Floodwall Systems – 100- Year Level of Protection

One part of this alternative consists of an approximately 4,200 foot-long floodwall placed around the Crampton Avenue neighborhood with an elevation of 12 feet NGVD above ground. The alternative would also include the raising of Port Reading Avenue. The other part of this potential flood control scenario would include placing a 12 foot NGVD above ground floodwall around the Ideal Mobile Home Park. This floodwall would extend approximately 1,850 feet.

### **Alternative 4:** Tide Gate with Tidal Levee System - 100-Year Level of Protection (Upstream of the NJ Turnpike Bridge)

The proposed tide gate is a pile supported, stand-alone structure that does not need the New Jersey Turnpike Bridge for stability or support. The top elevation of the tide gate is at 13 feet NGVD (height between 5 to 9 feet). In addition to the tide gate structure, a levee system must be included to prevent the tide from circumventing the tide gate and flooding developed areas. The levee system would be approximately 4,140 linear feet in length. The endpoints of the levee system would be connected to higher ground at an elevation of 13 feet NGVD. One endpoint would be in the vicinity of the NJ Transit Bridge & NJ Turnpike and the other endpoint would be in the vicinity of the intersection of Austin and Summit Streets.



**Alternative 5:** Tide Gate with Tidal Levee System - 50-Year Level of Protection  
(Downstream of the NJ Turnpike Bridge)

The proposed tide gate is a pile supported, stand-alone structure that does not require the New Jersey Turnpike Bridge for stability or support. The top elevation of the tide gate is at 12 feet NGVD (height between 4 to 8 feet). In addition to the tide gate structure, a levee system must be included to prevent the tide from circumventing the tide gate and flooding developed areas. The levee system would be approximately 1,074 linear feet in length. The endpoints of the levee system would be connected to higher ground at an elevation of 12 feet NGVD. One endpoint would be in the vicinity of Woodbridge Avenue & NJ Turnpike and the other endpoint in the vicinity of the intersection of NJ Turnpike rest area.

**Alternative 6:** Tide Gate with Tidal Levee System - 50-Year Level of Protection  
(Upstream of the Woodbridge Avenue Bridge)

The proposed tide gate would be a pile supported, stand-alone structure. The top elevation of the tide gate would be at 12 feet NGVD (height between 4 to 8 feet). In addition to the tide gate structure, a levee system must be included to prevent the tide from circumventing the tide gate and flooding developed areas. The levee system would be approximately 924 linear feet in length. The endpoints of the levee system would be connected to higher ground at an elevation of 12 feet NGVD. One endpoint would be in the vicinity of Woodbridge Avenue & NJ Turnpike and the other endpoint in the vicinity of the intersection of Austin and Summit Streets.

**Alternative 6A:** Tide Gate with Tidal Levee System – 25 -Year Level of Protection  
(Upstream of the Woodbridge Avenue Bridge)

Alternative 6A was developed by Najarian Associates for Woodbridge Township. This plan is a modified version of Alternative 6. The plan consists of a levee system approximately 300 linear feet in length in conjunction with a tide gate, both at an elevation of 11 feet NGVD.

**100-year Design Level**

Alternatives 1, 2, 3, and 4 are designed for a 100-year non-exceedance event. Table 12 summarizes the with-project average annual damages for structural, content and other damages for the manufactured homes in the Ideal Mobile Home Park Community.



**TABLE 12. WOODBRIDGE, NJ  
AVERAGE ANNUAL STORM DAMAGE  
WITH TIDE GATE 100yr. Design Oct. 2004 P.L.  
MANUFACTURED HOME MFE 2.5ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$6,814,087		\$13,628	\$52,569
		0.2%		\$6,814,087		
500	0.2%		\$6,814,087		\$17,669	\$38,941
		0.3%		\$5,889,582		
200	0.5%		\$4,965,076		\$21,255	\$21,272
		0.5%		\$4,259,458		
100.1	1.0%		\$3,553,840		\$18	\$18
		0.0%		\$1,776,920		
100	1.0%		\$0		\$0	\$0
		1.0%		\$0		
50	2.0%		\$0		\$0	\$0
		2.0%		\$0		
25	4.0%		\$0		\$0	\$0
		6.0%		\$0		
10	10.0%		\$0		\$0	\$0
		10.0%		\$0		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			

Tables 13 through 16 summarize the with-project average annual damages for structural, content and other damages for cape cod structures in the Crampton Avenue neighborhood. The average annual damages were calculated for structures with main floor elevations of 2 feet, 3 feet, 4 feet, and 5 feet.



**TABLE 13. WOODBRIDGE, NJ  
AVERAGE ANNUAL STORM DAMAGE  
WITH TIDE GATE 100yr. Design Oct. 2004 P.L.  
Cape Cod MFE 2ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$12,266,664		\$24,533	\$94,532
		0.2%		\$12,266,664		
500	0.2%		\$12,266,664		\$31,102	\$69,999
		0.3%		\$10,367,228		
200	0.5%		\$8,467,792		\$34,648	\$38,897
		0.5%		\$6,943,444		
100.1	1.0%		\$5,419,096		\$28	\$4,249
		0.0%		\$2,814,268		
100	1.0%		\$209,439		\$1,266	\$4,221
		1.0%		\$126,581		
50	2.0%		\$43,723		\$820	\$2,955
		2.0%		\$40,988		
25	4.0%		\$38,254		\$1,518	\$2,135
		6.0%		\$25,300		
10	10.0%		\$12,346		\$617	\$617
		10.0%		\$6,173		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			



**TABLE 14. WOODBRIDGE, NJ  
AVERAGE ANNUAL STORM DAMAGE  
WITH TIDE GATE 100yr. Design Oct. 2004 P.L.  
Cape Cod MFE 3ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$9,814,462		\$19,629	\$72,856
		0.2%		\$9,814,462		
500	0.2%		\$9,814,462		\$24,606	\$53,227
		0.3%		\$8,201,862		
200	0.5%		\$6,589,262		\$26,101	\$28,622
		0.5%		\$5,230,592		
100.1	1.0%		\$3,871,922		\$20	\$2,521
		0.0%		\$1,998,359		
100	1.0%		\$124,796		\$759	\$2,501
		1.0%		\$75,873		
50	2.0%		\$26,950		\$494	\$1,742
		2.0%		\$24,720		
25	4.0%		\$22,490		\$890	\$1,248
		6.0%		\$14,828		
10	10.0%		\$7,166		\$358	\$358
		10.0%		\$3,583		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			



**TABLE 15. WOODBRIDGE, NJ  
AVERAGE ANNUAL STORM DAMAGE  
WITH TIDE GATE 100yr. Design Oct. 2004 P.L.  
Cape Cod MFE 4ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$7,836,171		\$15,672	\$54,564
		0.2%		\$7,836,171		
500	0.2%		\$7,836,171		\$19,023	\$38,892
		0.3%		\$6,340,984		
200	0.5%		\$4,845,797		\$18,205	\$19,869
		0.5%		\$3,648,211		
100.1	1.0%		\$2,450,625		\$13	\$1,665
		0.0%		\$1,266,467		
100	1.0%		\$82,309		\$494	\$1,652
		1.0%		\$49,384		
50	2.0%		\$16,459		\$315	\$1,158
		2.0%		\$15,744		
25	4.0%		\$15,029		\$598	\$843
		6.0%		\$9,966		
10	10.0%		\$4,904		\$245	\$245
		10.0%		\$2,452		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			



**TABLE 16. WOODBRIDGE, NJ  
AVERAGE ANNUAL STORM DAMAGE  
WITH TIDE GATE 100yr. Design Oct. 2004 P.L.  
Cape Cod MFE 5ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$6,016,570		\$12,033	\$38,497
		0.2%		\$6,016,570		
500	0.2%		\$6,016,570		\$13,719	\$26,463
		0.3%		\$4,573,105		
200	0.5%		\$3,129,639		\$11,646	\$12,744
		0.5%		\$2,333,894		
100.1	1.0%		\$1,538,149		\$8	\$1,098
		0.0%		\$796,159		
100	1.0%		\$54,169		\$328	\$1,090
		1.0%		\$32,809		
50	2.0%		\$11,450		\$213	\$762
		2.0%		\$10,652		
25	4.0%		\$9,853		\$391	\$549
		6.0%		\$6,510		
10	10.0%		\$3,166		\$158	\$158
		10.0%		\$1,583		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			

### 50-year Design Level

Alternatives 5 and 6 are designed for a 50-year non-exceedance event. Table 17 summarizes the with-project average annual damages for structural, content and other damages for the manufactured homes in the Ideal Mobile Home Park Community. Tables 18 through 21 summarize the with-project average annual damages for structural, content and other damages for cape cod structures in the Crampton Avenue neighborhood. The average annual damages were calculated for structures with main floor elevations of 2 feet, 3 feet, 4 feet, and 5 feet.



**TABLE 17. WOODBRIDGE, NJ  
AVERAGE ANNUAL STORM DAMAGE  
WITH TIDE GATE 50yr. Design Oct. 2004 P.L.  
MANUFACTURED HOME MFE 2.5ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$6,814,087		\$13,628	\$82,871
		0.2%		\$6,814,087		
500	0.2%		\$6,814,087		\$17,669	\$69,242
		0.3%		\$5,889,582		
200	0.5%		\$4,965,076		\$21,297	\$51,574
		0.5%		\$4,259,458		
100	1.0%		\$3,553,840		\$30,226	\$30,276
		1.0%		\$3,034,730		
50.1	2.0%		\$2,515,620		\$50	\$50
		0.0%		\$1,257,810		
50	2.0%		\$0		\$0	\$0
		2.0%		\$0		
25	4.0%		\$0		\$0	\$0
		6.0%		\$0		
10	10.0%		\$0		\$0	\$0
		10.0%		\$0		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			



**TABLE 18. WOODBRIDGE, NJ  
AVERAGE ANNUAL STORM DAMAGE  
WITH TIDE GATE 50yr. Design Oct. 2004 P.L.  
Cape Cod MFE 2ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$12,266,664		\$24,533	\$136,995
		0.2%		\$12,266,664		
500	0.2%		\$12,266,664		\$31,102	\$112,462
		0.3%		\$10,367,228		
200	0.5%		\$8,467,792		\$34,717	\$81,360
		0.5%		\$6,943,444		
100	1.0%		\$5,419,096		\$43,620	\$46,643
		1.0%		\$4,379,504		
50.1	2.0%		\$3,339,911		\$68	\$3,023
		0.0%		\$1,691,817		
50	2.0%		\$43,723		\$820	\$2,955
		2.0%		\$40,988		
25	4.0%		\$38,254		\$1,518	\$2,135
		6.0%		\$25,300		
10	10.0%		\$12,346		\$617	\$617
		10.0%		\$6,173		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			



**TABLE 19. WOODBRIDGE, NJ  
 AVERAGE ANNUAL STORM DAMAGE  
 WITH TIDE GATE 50yr. Design Oct. 2004 P.L.  
 Cape Cod MFE 3ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$9,814,462		\$19,629	\$101,947
		0.2%		\$9,814,462		
500	0.2%		\$9,814,462		\$24,606	\$82,318
		0.3%		\$8,201,862		
200	0.5%		\$6,589,262		\$26,153	\$57,713
		0.5%		\$5,230,592		
100	1.0%		\$3,871,922		\$29,775	\$31,560
		1.0%		\$2,989,397		
50.1	2.0%		\$2,106,873		\$43	\$1,785
		0.0%		\$1,066,912		
50	2.0%		\$26,950		\$494	\$1,742
		2.0%		\$24,720		
25	4.0%		\$22,490		\$890	\$1,248
		6.0%		\$14,828		
10	10.0%		\$7,166		\$358	\$358
		10.0%		\$3,583		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			



**TABLE 20. WOODBRIDGE, NJ  
 AVERAGE ANNUAL STORM DAMAGE  
 WITH TIDE GATE 50yr. Design Oct. 2004 P.L.  
 Cape Cod MFE 4ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$7,836,171		\$15,672	\$72,971
		0.2%		\$7,836,171		
500	0.2%		\$7,836,171		\$19,023	\$57,299
		0.3%		\$6,340,984		
200	0.5%		\$4,845,797		\$18,241	\$38,276
		0.5%		\$3,648,211		
100	1.0%		\$2,450,625		\$18,850	\$20,035
		1.0%		\$1,892,524		
50.1	2.0%		\$1,334,423		\$27	\$1,185
		0.0%		\$675,441		
50	2.0%		\$16,459		\$315	\$1,158
		2.0%		\$15,744		
25	4.0%		\$15,029		\$598	\$843
		6.0%		\$9,966		
10	10.0%		\$4,904		\$245	\$245
		10.0%		\$2,452		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			



**TABLE 21. WOODBRIDGE, NJ  
AVERAGE ANNUAL STORM DAMAGE  
WITH TIDE GATE 50yr. Design Oct. 2004 P.L.  
Cape Cod MFE 5ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$6,016,570		\$12,033	\$47,904
		0.2%		\$6,016,570		
500	0.2%		\$6,016,570		\$13,719	\$35,871
		0.3%		\$4,573,105		
200	0.5%		\$3,129,639		\$11,669	\$22,152
		0.5%		\$2,333,894		
100	1.0%		\$1,538,149		\$9,712	\$10,483
		1.0%		\$975,111		
50.1	2.0%		\$412,072		\$8	\$770
		0.0%		\$211,761		
50	2.0%		\$11,450		\$213	\$762
		2.0%		\$10,652		
25	4.0%		\$9,853		\$391	\$549
		6.0%		\$6,510		
10	10.0%		\$3,166		\$158	\$158
		10.0%		\$1,583		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			

### 25-year Design Level

Najarian Associates was retained by Woodbridge Township to review the flood-reduction Alternatives 1 through 6 provided in the “Woodbridge River Basin, New Jersey, Flood Damage Reduction and Ecosystem Restoration Draft Feasibility Report” New York District, U.S. Army Corps of Engineers (November 2005). Najarian Associates proposed an alternative that is similar in design to the Corps’ Alternative 6, but at a smaller scale. Our review of their design indicated that this alternative would provide non-exceedance for a 25-year storm event. This alternative will be known as Alternative 6A.

Table 22 summarizes the with-project average annual damages for structural, content and other damages for the manufactured homes in the Ideal Mobile Home Park Community. Tables 23 through 26 summarize the with-project average annual damages for structural, content and other damages for cape cod structures in the Crampton Avenue neighborhood. The average annual damages were calculated for structures with main floor elevations of 2 feet, 3 feet, 4 feet, and 5 feet.



**TABLE 22. WOODBRIDGE, NJ  
 AVERAGE ANNUAL STORM DAMAGE  
 WITH TIDE GATE 25yr. Design Oct. 2004 P.L.  
 MANUFACTURED HOME MFE 2.5ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$6,814,087		\$13,628	\$111,017
		0.2%		\$6,814,087		
500	0.2%		\$6,814,087		\$17,669	\$97,389
		0.3%		\$5,889,582		
200	0.5%		\$4,965,076		\$21,297	\$79,720
		0.5%		\$4,259,458		
100	1.0%		\$3,553,840		\$30,347	\$58,423
		1.0%		\$3,034,730		
50	2.0%		\$2,515,620		\$28,051	\$28,075
		2.0%		\$1,413,796		
25.1	4.0%		\$311,971		\$25	\$25
		0.0%		\$155,986		
25	4.0%		\$0		\$0	\$0
		6.0%		\$0		
10	10.0%		\$0		\$0	\$0
		10.0%		\$0		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			



**TABLE 23. WOODBRIDGE, NJ  
AVERAGE ANNUAL STORM DAMAGE  
WITH TIDE GATE 25yr. Design Oct. 2004 P.L.  
Cape Cod MFE 2ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$12,266,664		\$24,533	\$184,782
		0.2%		\$12,266,664		
500	0.2%		\$12,266,664		\$31,102	\$160,248
		0.3%		\$10,367,228		
200	0.5%		\$8,467,792		\$34,717	\$129,147
		0.5%		\$6,943,444		
100	1.0%		\$5,419,096		\$43,795	\$94,429
		1.0%		\$4,379,503		
50	2.0%		\$3,339,911		\$48,374	\$50,634
		2.0%		\$2,438,106		
25.1	4.0%		\$1,536,301		\$125	\$2,261
		0.0%		\$787,278		
25	4.0%		\$38,254		\$1,518	\$2,135
		6.0%		\$25,300		
10	10.0%		\$12,346		\$617	\$617
		10.0%		\$6,173		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			



**TABLE 24. WOODBRIDGE, NJ  
AVERAGE ANNUAL STORM DAMAGE  
WITH TIDE GATE 25yr. Design Oct. 2004 P.L.  
Cape Cod MFE 3ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$9,814,462		\$19,629	\$132,544
		0.2%		\$9,814,462		
500	0.2%		\$9,814,462		\$24,606	\$112,916
		0.3%		\$8,201,862		
200	0.5%		\$6,589,262		\$26,153	\$88,310
		0.5%		\$5,230,592		
100	1.0%		\$3,871,922		\$29,894	\$62,157
		1.0%		\$2,989,397		
50	2.0%		\$2,106,873		\$30,933	\$32,263
		2.0%		\$1,559,054		
25.1	4.0%		\$1,011,236		\$82	\$1,330
		0.0%		\$516,863		
25	4.0%		\$22,490		\$890	\$1,248
		6.0%		\$14,828		
10	10.0%		\$7,166		\$358	\$358
		10.0%		\$3,583		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			



**TABLE 25. WOODBRIDGE, NJ  
AVERAGE ANNUAL STORM DAMAGE  
WITH TIDE GATE 25yr. Design Oct. 2004 P.L.  
Cape Cod MFE 4ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$7,836,171		\$15,672	\$92,363
		0.2%		\$7,836,171		
500	0.2%		\$7,836,171		\$19,023	\$76,690
		0.3%		\$6,340,984		
200	0.5%		\$4,845,797		\$18,241	\$57,668
		0.5%		\$3,648,211		
100	1.0%		\$2,450,625		\$18,925	\$39,426
		1.0%		\$1,892,524		
50	2.0%		\$1,334,423		\$19,606	\$20,501
		2.0%		\$988,162		
25.1	4.0%		\$641,901		\$52	\$895
		0.0%		\$328,465		
25	4.0%		\$15,029		\$598	\$843
		6.0%		\$9,966		
10	10.0%		\$4,904		\$245	\$245
		10.0%		\$2,452		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			



**TABLE 26. WOODBRIDGE, NJ  
AVERAGE ANNUAL STORM DAMAGE  
WITH TIDE GATE 25yr. Design Oct. 2004 P.L.  
Cape Cod MFE 5ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$6,016,570		\$12,033	\$62,645
500	0.2%	0.2%	\$6,016,570	\$6,016,570	\$13,719	\$50,612
200	0.5%	0.3%	\$3,129,639	\$4,573,105	\$11,669	\$36,893
100	1.0%	0.5%	\$1,538,149	\$2,333,894	\$12,001	\$25,223
50	2.0%	1.0%	\$862,043	\$1,200,096	\$12,640	\$13,222
25.1	4.0%	2.0%	\$412,072	\$637,057	\$34	\$582
25	4.0%	0.0%	\$9,853	\$210,963	\$391	\$549
10	10.0%	6.0%	\$3,166	\$6,510	\$158	\$158
5	20.0%	10.0%	\$0	\$1,583	\$0	\$0
2	50.0%	30.0%	\$0	\$0	\$0	\$0

### Benefit Cost Analysis

Alternatives 1 through 4 provide protection against a 100-year storm event; their associated costs are provided in Table 27.

<b>100yr Design</b>	<b>Alternatives Plans</b>			
	1	2	3	4
Construction Cost	\$ 21,997,700	\$ 10,050,500	\$ 10,250,500	\$ 5,070,100
Interest During Construction	\$ 989,010	\$ 451,867	\$ 460,859	\$ 227,950
Annual Construction Cost	\$ 1,332,800	\$ 608,900	\$ 621,100	\$ 307,200
Annual O&M Costs	\$ -	\$ 43,100	\$ 53,275	\$ 2,000
Total Annual Costs	\$ 1,332,800	\$ 652,000	\$ 674,375	\$ 309,200



Alternatives 5 and 6 provide protection against a 50-year storm event; their associated costs are provided in Table 28.

<b>Table 28. Costs of Alternative Plans (Oct. 2004 P.L.)</b>		
<b>50yr Design</b>	<b>Alternatives Plans</b>	
	5	6
Construction Cost	\$ 3,262,800	\$ 3,745,800
Interest During Construction	\$ 101,783	\$ 85,655
Annual Construction Cost	\$ 195,100	\$ 164,200
Annual O&M Costs	\$ 22,000	\$ 35,284
Total Annual Costs	\$ 217,100	\$ 199,484

Alternative 6A provides protection against a 25-year storm event. The estimated annual cost for Alternative 7 is \$150,000, based on calculations by Najarian Associates.

As previously stated, a complete structural inventory of the study area was not performed. It is assumed that all manufactured homes situated in the Ideal Mobile Home Community have their main floor elevation at 2.5 feet. Damage levels for the cape cod structures in the Crampton Avenue neighborhood were calculated under four scenarios: all structures with a main floor at 2 feet, 3 feet, 4 feet, and 5 feet. Tables 29 through 31 summarize the benefits for each the 100-year, 50-year, and 25-year non-exceedance design.

<b>Table 29. Annual Benefits - Crampton Avenue (Oct. 2004 P.L.)</b>				
<b>100yr Design</b>	<b>Main Floor Elevations</b>			
	2ft.	3ft.	4ft.	5ft.
Without-Project Damages	\$ 264,086	\$ 182,955	\$ 124,560	\$ 83,638
With-Project Damages	\$ 94,532	\$ 72,856	\$ 54,564	\$ 38,497
With-Project Benefits	\$ 169,554	\$ 110,099	\$ 69,996	\$ 45,141

<b>Table 30. Annual Benefits - Crampton Avenue (Oct. 2004 P.L.)</b>				
<b>50yr Design</b>	<b>Main Floor Elevations</b>			
	2ft.	3ft.	4ft.	5ft.
Without-Project Damages	\$ 264,086	\$ 182,955	\$ 124,560	\$ 83,638
With-Project Damages	\$ 136,995	\$ 101,947	\$ 72,971	\$ 47,904
With-Project Benefits	\$ 127,091	\$ 81,008	\$ 51,589	\$ 35,734



<b>Table 31. Annual Benefits - Crampton Avenue (Oct. 2004 P.L.)</b>				
25yr Design	Main Floor Elevations			
	2ft.	3ft.	4ft.	5ft.
Without-Project Damages	\$ 264,086	\$ 182,955	\$ 124,560	\$ 83,638
With-Project Damages	\$ 184,782	\$ 132,544	\$ 92,363	\$ 62,645
With-Project Benefits	\$ 79,304	\$ 50,411	\$ 32,197	\$ 20,993

<b>Table 32. Annual Benefits - Ideal Mobile Home Park (Oct. 2004 P.L.)</b>			
	100yr Design	50yr Design	25yr Design
Without-Project Damages	\$ 120,577	\$ 120,577	\$ 120,577
With-Project Damages	\$ 52,569	\$ 82,871	\$ 111,017
With-Project Benefits	\$ 68,008	\$ 37,706	\$ 9,560

## ALTERNATIVE PLAN SELECTION

### Flood Damage Reduction Benefits

Residual damages were subtracted from the residential structure damage categories. Average annual benefits were calculated by amortizing the average damages through the 50-year period of analysis at a discount rate of 5 <sup>3</sup>/<sub>8</sub>%.

### 100-year Design Level

<b>Table 33. Benefit Cost Analysis of Alternative Plans (Oct. 2004 P.L.)</b>				
Alternative 1	Main Floor Elevation			
	2 ft.	3 ft.	4 ft.	5 ft.
Annual Benefits	\$ 237,562	\$ 178,107	\$ 138,004	\$ 113,149
Annual Costs	\$ 1,332,800	\$ 1,332,800	\$ 1,332,800	\$ 1,332,800
Net Benefits	\$ (1,095,238)	\$ (1,154,693)	\$ (1,194,796)	\$ (1,219,651)
Benefit-Cost-Ratio	0.2	0.1	0.1	0.1

<b>Table 34. Benefit Cost Analysis of Alternative Plans (Oct. 2004 P.L.)</b>				
Alternative 2	Main Floor Elevation			
	2 ft.	3 ft.	4 ft.	5 ft.
Annual Benefits	\$ 237,562	\$ 178,107	\$ 138,004	\$ 113,149
Annual Costs	\$ 652,000	\$ 652,000	\$ 652,000	\$ 652,000
Net Benefits	\$ (414,438)	\$ (473,893)	\$ (513,996)	\$ (538,851)
Benefit-Cost-Ratio	0.4	0.3	0.2	0.2



<b>Table 35. Benefit Cost Analysis of Alternative Plans (Oct. 2004 P.L.)</b>				
<b>Alternative 3</b>				
<b>Main Floor Elevation</b>				
	2 ft.	3 ft.	4 ft.	5 ft.
Annual Benefits	\$ 237,562	\$ 178,107	\$ 138,004	\$ 113,149
Annual Costs	\$ 674,375	\$ 674,375	\$ 674,375	\$ 674,375
Net Benefits	\$ (436,813)	\$ (496,268)	\$ (536,371)	\$ (561,226)
Benefit-Cost-Ratio	0.4	0.3	0.2	0.2

<b>Table 36. Benefit Cost Analysis of Alternative Plans (Oct. 2004 P.L.)</b>				
<b>Alternative 4</b>				
<b>Main Floor Elevation</b>				
	2 ft.	3 ft.	4 ft.	5 ft.
Annual Benefits	\$ 237,562	\$ 178,107	\$ 138,004	\$ 113,149
Annual Costs	\$ 309,200	\$ 309,200	\$ 309,200	\$ 309,200
Net Benefits	\$ (71,638)	\$ (131,093)	\$ (171,196)	\$ (196,051)
Benefit-Cost-Ratio	0.8	0.6	0.4	0.4

### 50-year Design Level

<b>Table 37. Benefit Cost Analysis of Alternative Plans (Oct. 2004 P.L.)</b>				
<b>Alternative 5</b>				
<b>Main Floor Elevation</b>				
	2 ft.	3 ft.	4 ft.	5 ft.
Annual Benefits	\$ 164,797	\$ 118,714	\$ 89,295	\$ 73,440
Annual Costs	\$ 217,100	\$ 217,100	\$ 217,100	\$ 217,100
Net Benefits	\$ (52,303)	\$ (98,386)	\$ (127,805)	\$ (143,660)
Benefit-Cost-Ratio	0.8	0.5	0.4	0.3

<b>Table 38. Benefit Cost Analysis of Alternative Plans (Oct. 2004 P.L.)</b>				
<b>Alternative 6</b>				
<b>Main Floor Elevation</b>				
	2 ft.	3 ft.	4 ft.	5 ft.
Annual Benefits	\$ 164,797	\$ 118,714	\$ 89,295	\$ 73,440
Annual Costs	\$ 199,484	\$ 199,484	\$ 199,484	\$ 199,484
Net Benefits	\$ (34,687)	\$ (80,770)	\$ (110,189)	\$ (126,044)
Benefit-Cost-Ratio	0.8	0.6	0.4	0.4



## 25-year Design Level

<b>Table 39. Benefit Cost Analysis of Alternative Plans (Oct. 2004 P.L.)</b>				
<b>Alternative 6A</b>	<b>Main Floor Elevation</b>			
	2 ft.	3 ft.	4 ft.	5 ft.
Annual Benefits	\$ 88,864	\$ 59,971	\$ 41,757	\$ 30,553
Annual Costs	\$ 150,000	\$ 150,000	\$ 150,000	\$ 150,000
Net Benefits	\$ (61,136)	\$ (90,029)	\$ (108,243)	\$ (119,447)
Benefit-Cost-Ratio	0.6	0.4	0.3	0.2

### Selected Plan

None of the alternatives have a net benefit greater than zero; therefore there is no Federal interest in this study.

### SENSITIVITY ANALYSIS

Separate stage frequency curves were developed based on the hydrology and hydraulics data provided by Najarian Associates<sup>5</sup>. An assumption was made that the proposed design is for a 100-year non-exceedance event, refer to Tables 40-41.

<b>TABLE 40. Stage Frequency Curve (Revised)</b>	
<b>Existing Conditions</b>	
Storm Event	Water Surface Elevation in feet (NGVD)
2 Yr.	6.1
5 Yr.	6.9
10 Yr.	7.4
25 Yr.	8.1
50 Yr.	8.9
100 Yr.	9.7
200 Yr.	10.4
500 Yr.	11.5

<b>TABLE 41. Stage Frequency Curve (Revised)</b>	
<b>With-Project Conditions 100 Yr. Design</b>	
Storm Event	Water Surface Elevation in feet (NGVD)
2 Yr.	5.19
5 Yr.	5.87
10 Yr.	6.27
25 Yr.	6.67
50 Yr.	6.9
100 Yr.	7.24
200 Yr.	10.4
500 Yr.	11.5

A table 42 summarizes the without-project average annual damages for structural, content and other damages for the manufactured homes in the Ideal Mobile Home Park Community. Tables 43 through 46 summarize the with-project average annual damages for structural, content and other damages for cape cod structures in the Crampton Avenue

<sup>5</sup> Refer to Hydrology & Hydraulics Appendix A for derivation of stage frequency curve.



neighborhood. The average annual damages were calculated for structures with main floor elevations of 2 feet, 3 feet, 4 feet, and 5 feet.

**TABLE 42. WOODBRIDGE, NJ (Revised Stage Frequency Curve)  
AVERAGE ANNUAL STORM DAMAGE  
WITHOUT-PROJECT CONDITIONS Oct. 2004 P.L.  
MANUFACTURED HOME MFE 2.5ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$3,193,095		\$6,386	\$31,342
		0.2%		\$3,193,095		
500	0.2%		\$3,193,095		\$8,136	\$24,956
		0.3%		\$2,712,051		
200	0.5%		\$2,231,007		\$6,968	\$16,820
		0.5%		\$1,393,652		
100	1.0%		\$556,297		\$3,991	\$9,852
		1.0%		\$399,147		
50	2.0%		\$241,996		\$3,280	\$5,860
		2.0%		\$164,004		
25	4.0%		\$86,011		\$2,580	\$2,580
		6.0%		\$43,005		
10	10.0%		\$0		\$0	\$0
		10.0%		\$0		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			

**TABLE 43. WOODBRIDGE, NJ (Revised Stage Frequency Curve)  
AVERAGE ANNUAL STORM DAMAGE  
WITHOUT-PROJECT CONDITIONS Oct. 2004 P.L.  
Cape Cod MFE 2ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$4,972,714		\$9,945	\$115,609
		0.2%		\$4,972,714		
500	0.2%		\$4,972,714		\$11,765	\$105,664
		0.3%		\$3,921,591		
200	0.5%		\$2,870,468		\$11,875	\$93,899
		0.5%		\$2,374,955		
100	1.0%		\$1,879,441		\$15,474	\$82,024
		1.0%		\$1,547,416		
50	2.0%		\$1,215,390		\$18,577	\$66,550
		2.0%		\$928,839		
25	4.0%		\$642,287		\$26,127	\$47,973
		6.0%		\$435,458		
10	10.0%		\$228,630		\$13,618	\$21,846
		10.0%		\$136,176		
5	20.0%		\$43,723		\$8,228	\$8,228
		30.0%		\$27,427		
2	50.0%		\$11,131			



**TABLE 44. WOODBRIDGE, NJ (Revised Stage Frequency Curve)  
AVERAGE ANNUAL STORM DAMAGE  
WITHOUT-PROJECT CONDITIONS Oct. 2004 P.L.  
Cape Cod MFE 3ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$3,303,430		\$6,607	\$72,975
		0.2%		\$3,303,430		
500	0.2%		\$3,303,430		\$7,655	\$66,368
		0.3%		\$2,551,818		
200	0.5%		\$1,800,206		\$7,469	\$58,712
		0.5%		\$1,493,767		
100	1.0%		\$1,187,328		\$9,949	\$51,244
		1.0%		\$994,862		
50	2.0%		\$802,395		\$11,945	\$41,295
		2.0%		\$597,252		
25	4.0%		\$392,108		\$15,990	\$29,350
		6.0%		\$266,494		
10	10.0%		\$140,879		\$8,391	\$13,360
		10.0%		\$83,915		
5	20.0%		\$26,950		\$4,969	\$4,969
		30.0%		\$16,563		
2	50.0%		\$6,175			

**TABLE 45. WOODBRIDGE, NJ (Revised Stage Frequency Curve)  
AVERAGE ANNUAL STORM DAMAGE  
WITHOUT-PROJECT CONDITIONS Oct. 2004 P.L.  
Cape Cod MFE 4ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$2,074,198		\$4,148	\$46,165
		0.2%		\$2,074,198		
500	0.2%		\$2,074,198		\$4,867	\$42,017
		0.3%		\$1,622,438		
200	0.5%		\$1,170,677		\$4,829	\$37,149
		0.5%		\$965,787		
100	1.0%		\$760,897		\$6,317	\$32,320
		1.0%		\$631,671		
50	2.0%		\$502,444		\$7,513	\$26,004
		2.0%		\$375,647		
25	4.0%		\$248,850		\$10,108	\$18,491
		6.0%		\$168,459		
10	10.0%		\$88,068		\$5,226	\$8,383
		10.0%		\$52,264		
5	20.0%		\$16,459		\$3,157	\$3,157
		30.0%		\$10,522		
2	50.0%		\$4,586			



**TABLE 46. WOODBRIDGE, NJ (Revised Stage Frequency Curve)  
 AVERAGE ANNUAL STORM DAMAGE  
 WITHOUT-PROJECT CONDITIONS Oct. 2004 P.L.  
 Cape Cod MFE 5ft.**

<b>STORM EVENT</b>	<b>PROBABILITY</b>	<b>DIFFERENCE IN PROBABILITIES</b>	<b>DAMAGES</b>	<b>AVERAGE OF DAMAGES</b>	<b>AVERAGE ANNUAL DAMAGE INTERVAL</b>	<b>SUMMATION</b>
~	0.0%		\$1,349,045		\$2,698	\$30,613
		0.2%		\$1,349,045		
500	0.2%		\$1,349,045		\$3,152	\$27,915
		0.3%		\$1,050,649		
200	0.5%		\$752,253		\$3,093	\$24,763
		0.5%		\$618,579		
100	1.0%		\$484,905		\$4,049	\$21,670
		1.0%		\$404,937		
50	2.0%		\$324,969		\$4,962	\$17,621
		2.0%		\$248,087		
25	4.0%		\$171,204		\$6,930	\$12,659
		6.0%		\$115,507		
10	10.0%		\$59,810		\$3,563	\$5,729
		10.0%		\$35,630		
5	20.0%		\$11,450		\$2,166	\$2,166
		30.0%		\$7,219		
2	50.0%		\$2,989			

A table 47 summarizes the with-project average annual damages for structural, content and other damages for the manufactured homes in the Ideal Mobile Home Park Community. Tables 48 through 51 summarize the with-project average annual damages for structural, content and other damages for cape cod structures in the Crampton Avenue neighborhood. The average annual damages were calculated for structures with main floor elevations of 2 feet, 3 feet, 4 feet, and 5 feet



**TABLE 47. WOODBRIDGE, NJ (Revised Stage Frequency Curve)  
 AVERAGE ANNUAL STORM DAMAGE  
 WITH TIDE GATE 100yr. Design Oct. 2004 P.L.  
 MANUFACTURED HOME MFE 2.5ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$3,193,095		\$6,386	\$21,479
		0.2%		\$3,193,095		
500	0.2%		\$3,193,095		\$8,136	\$15,093
		0.3%		\$2,712,051		
200	0.5%		\$2,231,007		\$6,954	\$6,957
		0.5%		\$1,393,652		
100.1	1.0%		\$556,297		\$3	\$3
		0.0%		\$278,149		
100	1.0%		\$0		\$0	\$0
		1.0%		\$0		
50	2.0%		\$0		\$0	\$0
		2.0%		\$0		
25	4.0%		\$0		\$0	\$0
		6.0%		\$0		
10	10.0%		\$0		\$0	\$0
		10.0%		\$0		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			



**TABLE 48. WOODBRIDGE, NJ (Revised Stage Frequency Curve)  
 AVERAGE ANNUAL STORM DAMAGE  
 WITH TIDE GATE 100yr. Design Oct. 2004 P.L.  
 Cape Cod MFE 2ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$4,972,714		\$9,945	\$37,793
		0.2%		\$4,972,714		
500	0.2%		\$4,972,714		\$11,765	\$27,847
		0.3%		\$3,921,591		
200	0.5%		\$2,870,468		\$11,851	\$16,082
		0.5%		\$2,374,954		
100.1	1.0%		\$1,879,441		\$10	\$4,231
		0.0%		\$1,044,440		
100	1.0%		\$209,439		\$1,266	\$4,221
		1.0%		\$126,581		
50	2.0%		\$43,723		\$820	\$2,955
		2.0%		\$40,988		
25	4.0%		\$38,254		\$1,518	\$2,135
		6.0%		\$25,300		
10	10.0%		\$12,346		\$617	\$617
		10.0%		\$6,173		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			



**TABLE 49. WOODBRIDGE, NJ (Revised Stage Frequency Curve)  
 AVERAGE ANNUAL STORM DAMAGE  
 WITH TIDE GATE 100yr. Design Oct. 2004 P.L.  
 Cape Cod MFE 3ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$3,303,430		\$6,607	\$24,224
		0.2%		\$3,303,430		
500	0.2%		\$3,303,430		\$7,655	\$17,617
		0.3%		\$2,551,818		
200	0.5%		\$1,800,206		\$7,454	\$9,962
		0.5%		\$1,493,767		
100.1	1.0%		\$1,187,328		\$7	\$2,508
		0.0%		\$656,062		
100	1.0%		\$124,796		\$759	\$2,501
		1.0%		\$75,873		
50	2.0%		\$26,950		\$494	\$1,742
		2.0%		\$24,720		
25	4.0%		\$22,490		\$890	\$1,248
		6.0%		\$14,828		
10	10.0%		\$7,166		\$358	\$358
		10.0%		\$3,583		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			



**TABLE 50. WOODBRIDGE, NJ (Revised Stage Frequency Curve)  
 AVERAGE ANNUAL STORM DAMAGE  
 WITH TIDE GATE 100yr. Design Oct. 2004 P.L.  
 Cape Cod MFE 4ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$2,074,198		\$4,148	\$15,491
		0.2%		\$2,074,198		
500	0.2%		\$2,074,198		\$4,867	\$11,343
		0.3%		\$1,622,438		
200	0.5%		\$1,170,677		\$4,819	\$6,475
		0.5%		\$965,787		
100.1	1.0%		\$760,897		\$4	\$1,656
		0.0%		\$421,603		
100	1.0%		\$82,309		\$494	\$1,652
		1.0%		\$49,384		
50	2.0%		\$16,459		\$315	\$1,158
		2.0%		\$15,744		
25	4.0%		\$15,029		\$598	\$843
		6.0%		\$9,966		
10	10.0%		\$4,904		\$245	\$245
		10.0%		\$2,452		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			



**TABLE 51. WOODBRIDGE, NJ (Revised Stage Frequency Curve)  
 AVERAGE ANNUAL STORM DAMAGE  
 WITH TIDE GATE 100yr. Design Oct. 2004 P.L.  
 Cape Cod MFE 5ft.**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0.0%		\$1,349,045		\$2,698	\$10,029
		0.2%		\$1,349,045		
500	0.2%		\$1,349,045		\$3,152	\$7,331
		0.3%		\$1,050,649		
200	0.5%		\$752,253		\$3,087	\$4,179
		0.5%		\$618,579		
100.1	1.0%		\$484,905		\$3	\$1,093
		0.0%		\$269,537		
100	1.0%		\$54,169		\$328	\$1,090
		1.0%		\$32,809		
50	2.0%		\$11,450		\$213	\$762
		2.0%		\$10,652		
25	4.0%		\$9,853		\$391	\$549
		6.0%		\$6,510		
10	10.0%		\$3,166		\$158	\$158
		10.0%		\$1,583		
5	20.0%		\$0		\$0	\$0
		30.0%		\$0		
2	50.0%		\$0			

The Najarian Associates study raised concerns that automobile damages were too low. Although automobile damages are included in the “other” category under depth damage functions in Table 4, additional automobile damage assessments were analyzed for the Ideal Mobile Home Park vicinity. An assumption was made that automobiles will be susceptible to flood damages for eight hours each night. Each home was assigned one vehicle with a depreciated replacement value of \$17,000. Table 52 shows the depth damage curve used to calculate automobile damages. Tables 53 and 54 summarize the automobile damages.



Table 52. AUTO DAMAGES	
Depth (Feet)	Percent Damage
0	0.00%
1	12.50%
1.1	15.00%
1.2	17.50%
1.3	20.00%
1.4	22.50%
1.5	25.00%
1.6	27.50%
1.7	30.00%
1.8	32.50%
1.9	35.00%
2	37.50%
2.1	38.33%
2.2	39.16%
2.3	39.99%
2.4	40.82%
2.5	41.65%
2.6	42.48%
2.7	43.31%
2.8	44.14%
2.9	44.97%
3	45.80%
3.1	49.22%
3.2	52.64%
3.3	56.06%
3.4	59.48%
3.5	62.90%
3.6	66.32%
3.7	69.74%
3.8	73.16%
3.9	76.58%
4	80.00%



**TABLE 53. IDEAL MOBILE HOME PARK WITHOUT-PROJECT  
AVERAGED ANNUAL STORM DAMAGE COMPUTATIONS  
AUTOMOBILE**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0		661,937		1,324	16,506
		0.002		661,937		
500	0.002		661,937		1,713	15,182
		0.003		571,047		
200	0.005		480,156		3,201	13,469
		0.008		400,157		
100	0.01		320,158		2,920	10,268
		0.01		291,970		
50	0.02		263,783		3,580	7,348
		0.02		178,996		
25	0.04		94,208		3,768	3,768
		0.08		47,104		
10	0.1		0		0	0
		0.1		0		
5	0.2		0		0	0
		0.4		0		
2	0.5		0			

**TABLE 54. IDEAL MOBILE HOME PARTK WITH-PROJECT  
AVERAGE ANNUAL STORM DAMAGE COMPUTATIONS  
AUTOMOBILE**

<u>STORM EVENT</u>	<u>PROBABILITY</u>	<u>DIFFERENCE IN PROBABILITIES</u>	<u>DAMAGES</u>	<u>AVERAGE OF DAMAGES</u>	<u>AVERAGE ANNUAL DAMAGE INTERVAL</u>	<u>SUMMATION</u>
~	0		661,937		1,324	5,035
		0.002		661,937		
500	0.002		661,937		1,713	3,712
		0.003		571,047		
200	0.005		480,156		1,997	1,998
		0.0050		400,157		
100.1	0.01		320,158		2	2
		0.000		160,079		
100	0.01		0		0	0
		0.01		0		
50	0.02		0		0	0
		0.02		0		
25	0.04		0		0	0
		0.08		0		
10	0.1		0		0	0
		0.1		0		
5	0.2		0		0	0
		0.4		0		
2	0.5					



Benefits were calculated for the Crampton Avenue area and summarized in Table 55. The benefits for Ideal Mobile Home Park structures and additional automobile damage benefits are summarized in Table 56.

<b>Table 55. Annual Benefits - Crampton Avenue (Oct. 2004 P.L.)</b>				
<b>100yr Design</b>	<b>Main Floor Elevations</b>			
	2ft.	3ft.	4ft.	5ft.
Without-Project Damages	\$115,609	\$72,975	\$46,165	\$30,613
With-Project Damages	\$37,793	\$24,224	\$15,491	\$10,029
With-Project Benefits	\$77,816	\$48,751	\$30,674	\$20,584

<b>Table 56. Annual Benefits - Ideal Mobile Home Park (Oct. 2004 P.L.)</b>	
<b>100yr Design</b>	
Without-Project Damages	\$47,848
With-Project Damages	\$26,514
With-Project Benefits	\$21,334

Cost figure for the 100-year non-exceedance design was obtained from Najarian Associates. Net benefits and benefit-cost-ratio are summarized in Table 57 below. There is no Federal interest in this study since the costs exceeds the benefits.

<b>Table 57. Benefit Cost Analysis of Alternative Plans (Oct. 2004 P.L.)</b>				
<b>Alternative 6B</b>	<b>Main Floor Elevation</b>			
	2 ft.	3 ft.	4 ft.	5 ft.
Annual Benefits	\$99,150	\$70,085	\$52,008	\$41,918
Annual Costs	\$150,000	\$150,000	\$150,000	\$150,000
Net Benefits	(\$50,850)	(\$79,915)	(\$97,992)	(\$108,082)
Benefit-Cost-Ratio	0.7	0.5	0.3	0.3

