Update of Project Benefits

February 2014

Long Beach Island, New York
Hurricane Sandy Limited Reevaluation Report
Benefits Update

Contents

Tables:

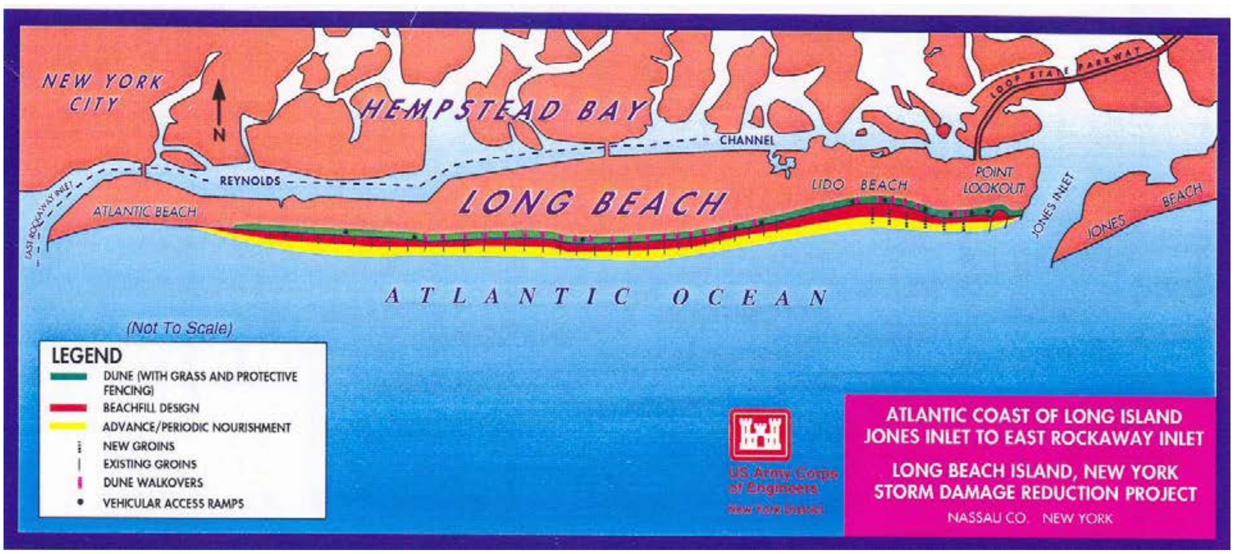
Figures:

1. Introduction

Long Beach Island, New York, lies on the Atlantic Coast of Long Island, and was the subject of a Storm Risk Management Feasibility Study which was completed in 1995. The project resulting from the Feasibility Study would provide storm risk management for the island's highly developed communities that are subject to wave attack and flooding during major storms and hurricanes.

The principal community benefiting from the project is the City of Long Beach, Nassau County. Also benefiting are the non-incorporated communities of Point Lookout and Lido Beach, both within the Town of Hempstead, and also in Nassau County (See Figure 1). The predominant land use in Long Beach is moderate to high density residential development consisting primarily of single family units, with areas of high density residential development consisting of high-rise apartments and condominiums along the oceanfront. There are occasional areas of moderate to high density commercial and other non-residential development, particularly in the City of Long Beach. The eastern end of the island is less urbanized, with substantial recreational areas separating the Lido Beach and Point Lookout communities.

Figure 1: Long Beach Island, New York



The populations of the various communities affected by the project are presented in Table 1. Data does not indicate any clear trend in the County population figures.

Table 1: Community Populations

Census Listed Community	Population	
	1990	2010
Nassau County	1,287,348	1,339,532
City of Long Beach	33,510	33,275
Town of Hempstead	725,639	759,757
Lido Beach Community	2,786	2,897

(Source: Census 1990 and 2010, US Census Bureau, US Department of Commerce)

2. Purpose of the Reevaluation Study

Subsequent to the completion of project pre-construction engineering and design work, there has been a reanalysis of the project area utilizing new modeling techniques, some updates to project design, and an update of construction quantities.

The reevaluation updates project benefits to help confirm the viability of the recommended project.

In this reevaluation, benefits have only been considered for the design alternative put forward by the Feasibility Study as the NED Plan, which was originally referred to in the Feasibility Study as Alternative 5. The NED plan generally provides a 110-foot wide berm backed by a dune system at an elevation of 15 feet above NGVD. Based on 1994 price levels, the NED Plan provided almost $17 million in annual benefits and annual net excess benefits of $8.36 million over the period of analysis of 50 years, with an overall benefit/cost ratio of 2.0.

3. Original Project Benefits

The estimates of all economic benefits were originally based on January 1994 price levels and reflected the economic condition of the floodplain as of 1992. A period of analysis of 50 years and an interest rate of 8% were used. In the Feasibility Study, the benefits to be derived from the improvement were listed as:

1. Reduction of damage associated with long-term and storm-induced erosion to structures
2. Reduction of wave attack to structures
3. Reduction in inundation of structures
4. Reduced emergency response and cleanup costs
5. Reduced costs for stabilizing the existing shoreline
6. Maintenance of existing recreation value
7. Increased recreation value
8. Prevention of loss of land

The first five of these categories were considered storm risk management benefits, and the original distribution of annual benefits for the NED plan is summarized in Table 2:

Table 2: Original Benefits of NED Plan (Cost Base January 1994, Discount Rate 8%)

Coastal Storm Risk Management Benefits	**Annual Benefit**	**% of Total**
Residential Structures		
Physical	$10,088,840	59.42
Emergency	$558,490	3.29
Commercial Structures		
Physical	$3,361,030	19.79
Emergency	$55,420	0.33
Other Structures		
Physical	$724,530	4.27
Emergency	$11,350	0.07
Reduced Damage to Infrastructure		
Infrastructure Damage	$152,750	0.90
Boardwalk/Access	$4,400	0.03
Reduced Public Emergency Costs		
Emergency Protection	$16,280	0.10
Sand/debris Removal	$28,200	0.17
Future Protection Costs Foregone		
Section 933 Costs	$400,000	2.36
Existing Structure Protection	$970	0.01
Other Benefits		
Recreation Benefits		
Recreation Enhancement	$937,160	5.52
Recreation Maintenance	$639,120	3.76
Loss of Land Benefits		
Loss of Land	$1,440	0.01
Total Benefits	$16,979,980	100

(January 1994, Discount Rate 8%)

A cost base of October 2013, a project base year of 2018, and a 3.5% Federal Discount Rate have been used in the updating of benefits for this report.

Only those benefits considered being significant to the overall viability of the project (i.e. the major benefits) have been updated in detail. Storm risk management measures for structures and recreational benefits are considered to be the "major" benefits, and the process of updating them is presented in detail in the following sections, whilst the other "minor" benefits have been updated by means of various update factors as appropriate.

4. Update of Residential Structure Benefits

For the 1995 Feasibility Study, an inventory/database of all structures in the study area was compiled, and generalized damage functions were developed for the various structure types. For residential structures, these functions took the form of curves relating flood depth to damage as a percentage of the structure's depreciated structure value, whereas damage functions for non-residential structures were based on a $ value per square foot of structure size. Damages were then calculated for residential and non-residential structures by identifying the type of damage causing the maximum impact at each structure for various storm frequencies.

Current USACE guidance requires the use of depreciated structure value as the only proper indicator of the value of resources subject to flood damage[1]. Depreciated structure value is preferred to the current market value because it provides a direct measure of the value of the physical structure: it takes into account local construction practices and costs, is not overly sensitive to interest rate fluctuations or regional economic conditions, and does not require a separate assessment of the value of the land on which the structure is located.

Residential damages for with and without project conditions have been revised for this reevaluation report by applying an update factor based on observed changes to residential structures in the study area that could have an impact on the depreciated structure value. To determine significant changes in the residential structure database since the 1995 Feasibility Study, a resurvey was undertaken based on a randomly selected sample of approximately 100 structures, intended to represent 1% of the total number of residential structures.

A cluster of structures for resurvey was identified in each project map area, the size of the cluster being approximately equal to the number of residential structures in that map area as a percentage of the overall total. The size of each cluster was adjusted to ensure a minimum of five structures in any one map area and a minimum of 30 structures in total in map areas covering the communities of Lido Beach and Point Lookout, within the Town of Hempstead.

Each cluster was identified by using a random number generating function to select an initial seed structure ID from the original printouts of SAS computer runs calculating structure values, and then taking the next structure IDs in sequence as appropriate to the size of the cluster. For each cluster, several additional structure IDs were added to allow for the possibility that structures encountered during the resurvey in the field would prove to be significantly altered. A total of 114 residential structures were resurveyed on site, of which 103 contributed to the derivation of the update factor.

Data from the resurvey was used to calculate the updated depreciated value of each structure. Each depreciated structure value was compared to its counterpart calculated for the Feasibility Study, and an update factor was calculated for use in the revision of storm risk management benefits for residential structures, based on the average change in depreciated structure value between the original study and the resurvey. Residential structure depreciation originally varied between 0% and 20% of the replacement value, with 10% being applied to the vast majority of structures. For this reevaluation it was found that depreciation in the resurvey sample currently varies between 0% and 45%, with a value of 15% for the majority of structures.

However, an update factor greater than unity can be seen as indicative that the value of new or replacement structures built since the feasibility study and of improvements or repairs to existing structures is more significant than the overall decrease in value that would be expected due to depreciation. Changes in the analysis technique may also be considered: Standard unit replacement costs for the feasibility study were based on the 1992 Means Square Foot Costs, adjusted to the regional area and verified by local building contractors, and used the original build quality of the structure as a surrogate indicator of condition and hence depreciation, whereas

1. Procedural Guidelines for Estimating Residential and Business Structure Value for Use in Flood Damage Estimations: Institute for Water Resources, 1995

current practice uses the Marshall & Swift Valuation Service, which requires a separate assessment of the current structure quality to measure deterioration or improvements to the structure.

Although an update factor calculated only for residential structures in the Town of Hempstead was found to be marginally lower than that for the whole project area, the difference was not significant enough to warrant more detailed investigation and the use of a separate update factor for this area when assessing the benefits of constructing the project in two independent elements.

In addition to the on-site re-surveying work, high resolution digital orthoimagery for Nassau County, made publicly available by the State of New York, was examined and compared to the original project mapping to assess changes to the structure inventory in areas other than those identified for detailed re-surveying. This study found that, as could be expected in a 20 year period, a small number of new residential structures had been constructed. Some of these new structures have replaced structures existent in 1993, and overall the estimated net value of new or replacement structures was not considered to be significant when compared to the overall total value of residential structures in the initial structure inventory. Hence it is assumed that updates to the residential damages are driven by the update factor resulting from the re-survey.

5. Update of Non-Residential Structure Benefits

In the Feasibility Study, replacement costs for non-residential structures (commercial, industrial, utility, and municipal) were based on the most typical construction practices within each usage, with reference to the Means Square Foot Cost Guide. These practices were determined to vary with the size of the structure and unit prices were varied accordingly. The original structure build quality was again used as an indicator of the physical depreciation.

Since less than 20% of the original benefits originated from damage to non-residential structures, a less detailed approach than for residential structures was used to update these benefits. Non-residential structure damages for with and without project conditions were updated by applying a cost index factor derived from Marshall & Swift valuation data, following a review of the original predicted sources of major non-residential damage.

The predominant structural material was examined for commercial and ‘other’ structures in the inventory, following which two update factors were determined, to reflect the observation that approximately 2/3 of commercial structures were of masonry construction, whereas ‘other’ structures were evenly divided between wood frame and masonry.

In the original analysis the possibility that a particularly vulnerable structure might be lost to erosion or wave damage between the feasibility study and the base year of the project was modeled by giving the structure an existence probability of less than 1 in the base year, and adjusting the annual average damage attributable to it accordingly. The original damage calculations were reviewed to determine whether or not there were any such significant structures whose damages should be adjusted upwards to account for the intact existence of the structure in 2003. This study did not find any structures that had been lost in the last 10 years, and any consequent adjustments were considered to be negligible and thus not applied.

As with residential structures, detailed orthoimagery for Nassau County (provided by New York State) was examined to determine the presence of significant new build or replacement structures, especially in the oceanfront area, where a large proportion of any storm damage would be expected to occur. The oceanfront is predominantly residential in character and both the study of aerial photographs and site visits did not suggest significant changes to the overall value of vulnerable non-residential structures.

6. Risk and Uncertainty

USACE Policy is to acknowledge that some of the inputs to the analysis of flood damage reflect best estimates and that actual values may vary. Studies are subject to the requirements and guidance set out in the following policy documents:

ER 1105-2-101: Risk Analysis for Flood Damage Reduction Studies
EM 1110-2-1619: Risk-Based Analysis for Flood Damage Reduction Studies

It is intended that all flood risk or storm risk management studies follow a comprehensive approach in which all key variables, parameters, and components are subject to probabilistic analyses. Key variables and parameters in the Long Beach analysis were evaluated to determine their significance in the damage and benefit estimates and approaches to incorporating uncertainty in their values. Table 3 provides a summary of the parameters for which uncertainty was considered.

Table 3: Uncertainty Distributions for Benefit Analysis

Uncertain Parameters	Distribution Type	Mean	Variance /St Dev	Lower Bound	Upper Bound
Recession Distance (ft)	Normal	Varies with frequency	2.70%		
Runup Distance	Normal	Varies with frequency	2.20%		
Runup Elevation	Normal	Varies with frequency	2.50%		
Long term Erosion (ft per year) Reach LB1 used for Example	*Triangular*	*0*		*-6.67*	*5.00*
Dune Elevation	*Normal*	*Varies by Reach*	*0.6*		
Rebuild Distance (ft)	Normal	Varies by location	20		
Weir Coefficient	Triangular	3.0		2.8	3.1
Manning Roughness	Triangular	0.04		0.013	0.070
Structure Value	Normal	Varies with structure	30%		
Content Value	Normal	Varies with structure	30%		
Wave Failure Height (Wood)	Triangular	3.0		2.7	3.3
Wave Failure Height (Masonry)	Triangular	3.3		3.0	4.0
Erosion Damage /Sq Ft undermined, High Rise	Normal	$16	20%		
Setback Distance (ft)	Normal	Varies with structure	15		

Uncertainty was applied by executing multiple iterations of lifecycle damages. Mean damages from the various lifecycles were calculated and incorporated into the damage summary tables.

7. Update of Recreation Benefits

For the estimation of recreational benefits in the Feasibility Study, simulated demand curves were developed to model the hypothetical behavior of people visiting the various beaches along the project area and their willingness to pay to use these beaches, given that the project creates the potential for an enhanced recreation experience. These curves were based on the results of a comprehensive questionnaire survey carried out in July and August of 1992 which asked beach visitors about their willingness to pay to use the beaches with and without the implementation of the project, and their visitation patterns. Beach use values were forecast using a use estimating model that assumed the increase in beach use would follow the projected growth of the local populations. Annual beach use and attendance data was acquired from the local authorities in various forms: For Long Beach, the total numbers of daily and season passes sold were obtained, for beaches operated by the Town of Hempstead the attendance was derived from the number of parking tickets sold, and for Nassau Beach attendance figures were received directly from County sources.

Since the recreation benefits contribute less than 10% of the overall project benefits, it was not considered necessary to conduct additional beach use surveys. It was considered sufficient for this study to update the simulated demand curves with the Willingness To Pay prices updated using Consumer Price Index and recent beach attendance data from the relevant local authorities. Where the attendance figures were found to show a significant deviation from the original visitation forecast, adjustments were incorporated into the future use estimator model. Recent beach attendance data received from the Town of Hempstead had been allocated to a number of separate beaches, which were then assigned to the two originally designated main beaches (Lido Beach and Point Lookout Beach), to ensure that valid comparisons with the Feasibility Report.

Table 4 presents summarized average beach attendance figures from the original analysis and for the period since the Feasibility Report, derived from data provided by local authorities.

Table 4: Beach Attendances

Location	Average Attendance 1992 – 1993	Average Attendance 2008 - 2010
Long Beach		
Daily Pass	139,411	212,718
Season Pass	741,383	563,855
Lido Beach	123,567	278,649
Nickerson/Malibu Beach	340,511	466,468
Point Lookout Beach	133,896	283,332

Nassau County operates the Nickerson and Malibu Beach areas. Attendance at Nickerson Beach was found to have declined noticeably in recent years. Local officials attributed this to a range of factors including the deterioration of facilities and the increasing width of the beach, which discourages many older and less mobile patrons from visiting. The decrease at Nickerson Beach has been offset by an increase in attendance at Malibu Beach.

Attendance at Point Lookout Beach was also found to be generally declining during the 1990's, but has recovered dramatically.

Only limited recent beach attendance data was received from Long Beach, and the figures suggested a steep decline in the use of season passes at some point between 1993 and 1996, for which no explanation has been suggested. Daily pass attendance has continued to increase.

8. Update of Minor Benefits

Reductions in damage to infrastructure, public emergency costs and loss of land benefits have been considered to be minor benefits, since together they contribute less than 4% of the total benefits originally provided by the project.

It is sufficient for the purposes of this reevaluation study to revise these benefits simply by applying appropriate update factors to the originally calculated benefits, as presented in Table 5, which summarizes the method of updates for the full range of benefits. No information was provided for revising figures for future protection costs, hence these damages have not been updated.

Table 5: Summary of Factors Used to Update Benefits

Benefit Category	Update Factor Source	Update Factor
Infrastructure Damage		
Infrastructure	ENR Construction Cost Index	1.89
Boardwalk/Access		1.89
Public Emergency Costs		
Emergency Protection	Consumer Price Index	1.58
Sand/Debris Removal		1.58
Future Protection Costs		
Section933 Costs	Not Updated	-
Existing Structure Protection		
Recreation		
Recreation Enhancement	Consumer Price Index and	1.58
Recreation Maintenance	recent beach attendance data	1.58
Loss of Land	Consumer Price Index	1.58

9. Summary of Updated Benefits

All updated benefits are presented in Table 6. These benefits were calculated assuming a project base year of 2018, a 50-year period of analysis, October 2013 price levels, and a Federal Discount Rate of 3.5%.

Table 6: Summary of Updated Benefits

HSLRR Recommended Plan Benefit Categories		
Residential	Physical	$8,661,000
	Emergency	$3,559,000
Apartment	Physical	$7,195,000
	Emergency	$157,000
Commercial	Physical	$3,556,000
	Emergency	$86,000
Industrial	Physical	$95,000
	Emergency	$2,000
Municipal	Physical	$734,000
	Emergency	$47,000
Utility	Physical	$85,000
	Emergency	$1,000
Sub Totals	*Physical*	*$20,326,000*
	Emergency	*$3,852,000*
Sub Total Structures		**$24,178,000**
Damage to Infrastructure		
	Infrastructure Damage	$289,000
	Boardwalk/Access	$8,000
Public Emergency Costs		
	Emergency Protection	$24,000
	Sand/Debris Removal	$40,000
Future Protection Costs		
	Section 933 Costs	$632,000
	Existing Structure Protection	$1,000
Recreation Benefits		
	Recreation Enhancement	$1,481,000
	Recreation Maintenance	$1,010,000
Loss of Land		$1,000
Sub Total Other Benefits		**$3,486,000**
Total Benefits		**$27,664,000**

(October 2013 Price Level, Discount Rate 3.5%)