FEDERAL INTEREST DETERMINATION
CONTINUING AUTHORITIES PROGRAM SECTION 205
FLOOD RISK MANAGEMENT STUDY

DELAWARE BAYSHORE, DE

PREPARED BY:
DEPARTMENT OF THE
ARMY CORPS OF
ENGINEERS PHILADELPHIA
DISTRICT

November 2015
Updated April 2016

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Delaware Bayshore, DE

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CAP SECTION 205

DELAWARE BAYSHORE, DE

FEDERAL INTEREST DETERMINATION

1. Project Name: Delaware Bayshore, DE, Continuing Authorities Program (CAP) Section 205 Flood Risk Management Study (P2# 402329).

2. Congressional Delegation: Senators Thomas Carper and Christopher Coons (DE), Representative John Carney Jr. (DE-At Large).

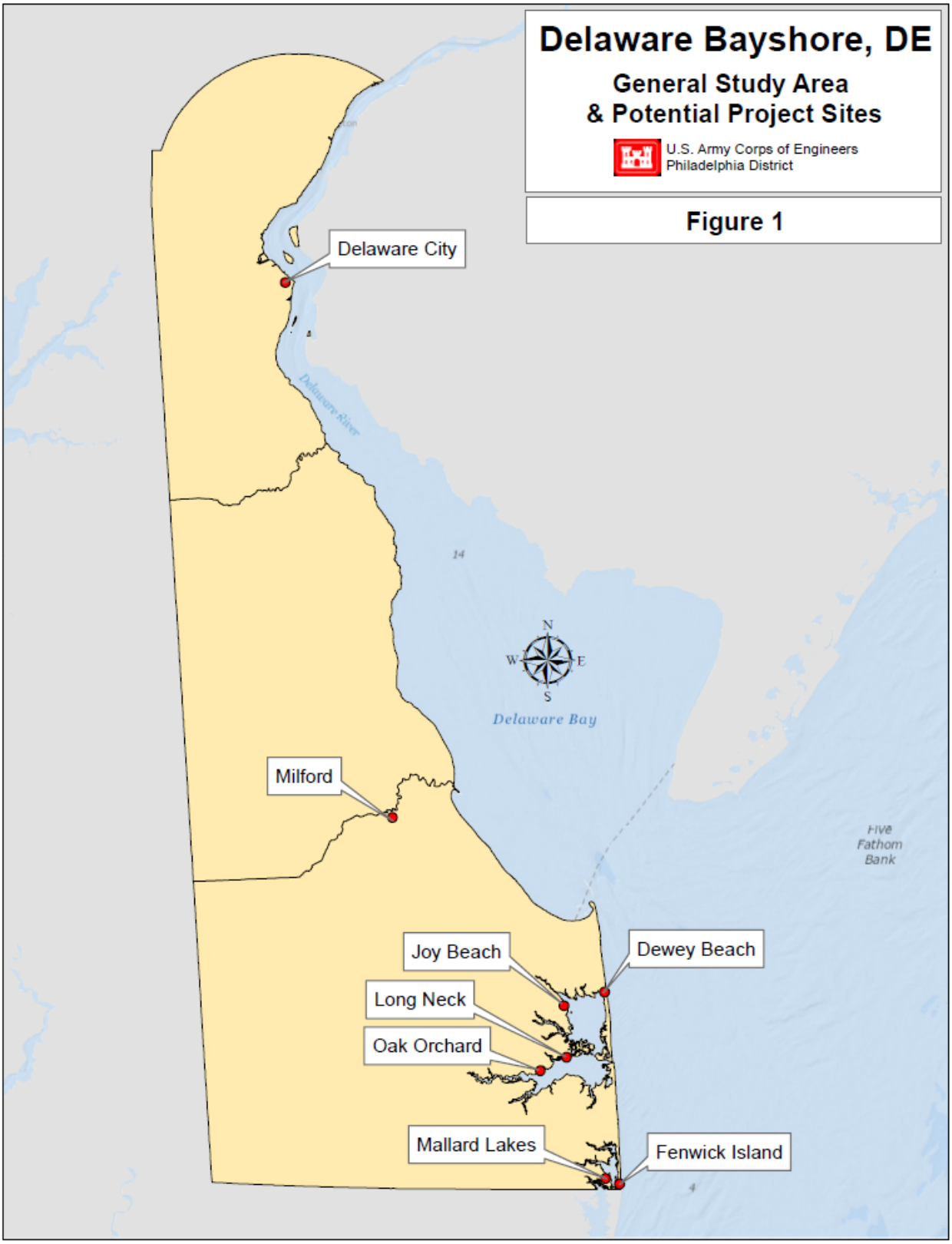
3. Project Purpose and Description:

This Federal Interest Determination (FID) is authorized under Section 205 of the CAP which provides for projects to address flood risk management. Funding for this FID investigation has been provided by Public Law 113-2, the Disaster Relief Appropriations Act of 2013 approved January 29, 2013.

Hurricane Sandy made landfall on October 29, 2012 as a "post-tropical cyclone" with wind speeds of 90 mph, causing extensive flooding, beach erosion, and coastal damage along the shorelines of Delaware, New Jersey, and New York. The storm weakened over Pennsylvania, degenerating into a remnant trough on October 31. As Sandy made landfall on the Delaware coast, it generated intense onshore winds, waves, and a storm surge that was augmented by excessive spring tides associated with the full moon of October 29th. The combined effects of wind, waves, and elevated tidal water levels led to significant erosion damage to the Delaware Bayshore area. The general Delaware Bayshore study area with potential project sites labeled is shown in Figure 1.

This FID report addresses flood risk management for communities in the Little Assawoman Bay & Vicinity area. (Figure 2). This area is subject to flood damage due to specific storm events. The objective of this FID investigation was to recommend at least one policy-compliant solution to a problem identified in the study area. The scope of the solution must be appropriate for the CAP (Continuing Authorities Program). The FID investigation determines whether Federal interest in a future CAP-level feasibility study is warranted. This study is currently the only FID investigation covering the Delaware Bayshore (inland bay area).

After a thorough plan formulation and screening process, a selected site (Mallard Lakes) and proposed plan of improvement (structure elevation) were recommended. A representative structure at Mallard Lakes was analyzed. The results may be used in the future to evaluate other sites in the study area with structures having similar characteristics.


Delaware Bayshore, DE
General Study Area
& Potential Project Sites
U.S. Army Corps of Engineers
Philadelphia District
Figure 1
Delaware City
Delaware River
Delaware Bay
Milford
Joy Beach
Dewey Beach
Long Neck
Oak Orchard
Mallard Lakes
Fenwick Island
Five Fathom Bank
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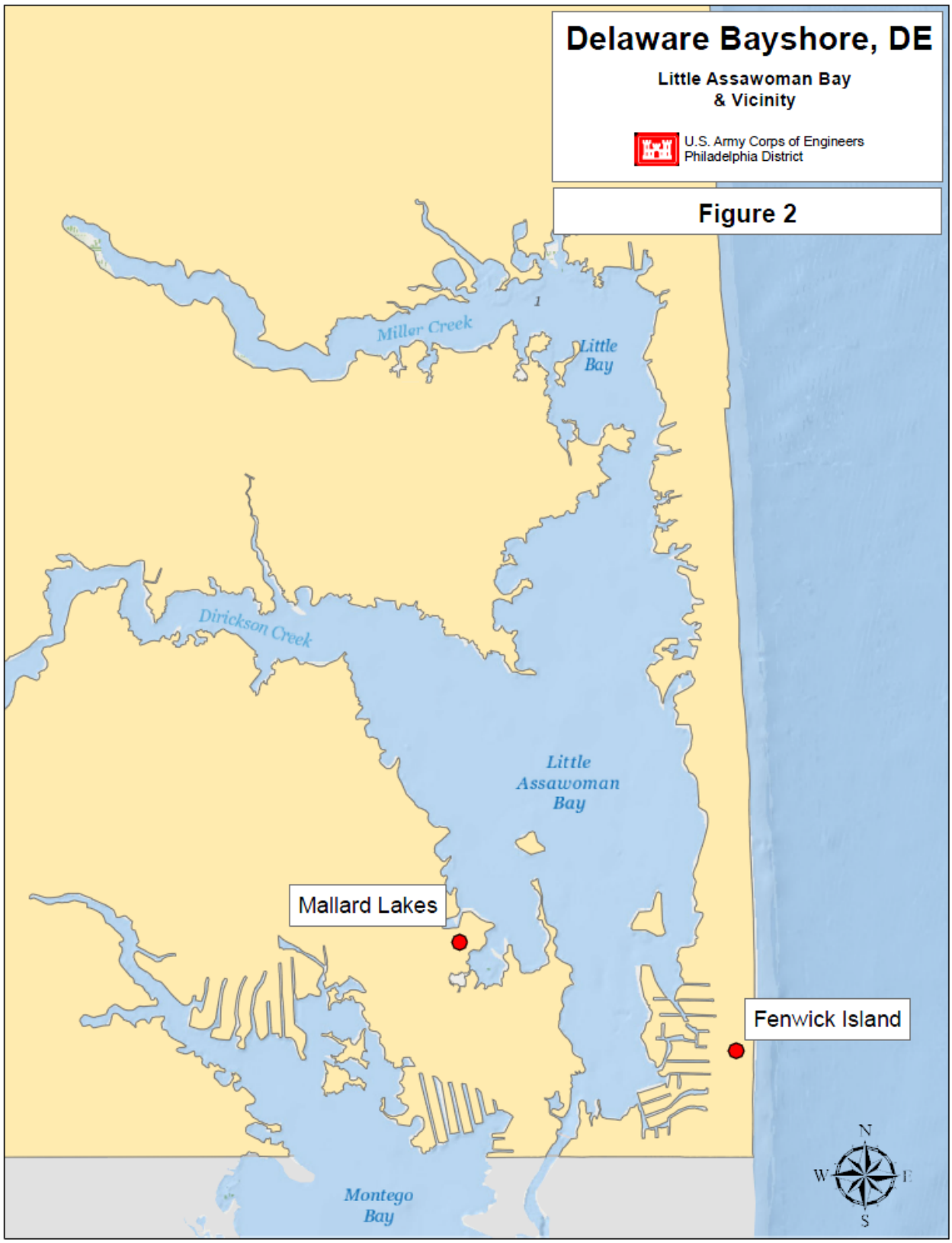
Delaware Bayshore, DE
Little Assawoman Bay
& Vicinity
U.S. Army Corps of Engineers
Philadelphia District
Figure 2
Miller Creek
Little Bay
Dirickson Creek
Little Assawoman Bay
Mallard Lakes
Fenwick Island
Montego Bay
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4. Existing Conditions:

The Delaware Bayshore, DE flood risk management study area is located in Sussex County, Delaware. (Figure 2) Sussex County is the southernmost of the three counties in the state of Delaware. This study area is located in the southeastern corner of Sussex County, adjacent to the Maryland state line. Little Assawoman Bay is situated on the bayside of the barrier island extending between the towns of Fenwick Island and South Bethany. It is characterized by medium density urban residential and beach community development. The shoreline in this area varies with beaches, wetlands, and urban development. Delaware State Route 1 is the major transportation artery. The study area is connected to the Atlantic Ocean via Indian River Inlet and Assawoman Canal; therefore, it is exposed to tidal effects. The inland bays interact with the ocean through a flushing and draining process. During storm events, higher sea levels and prevailing winds make it more difficult for water to exit the bays, thereby increasing surface water elevations.

There is a significant volume of wetland acreage along the inland bay area. Saltmarshes act as nurseries for a wide variety of organisms, and are an essential habitat for migratory birds. Additionally, the marshes benefit humans and the ecosystem by sheltering the coast from erosion, and functioning as the ecosystem's filtration system for contaminants, nutrients, and sediment. Unfortunately, high rates of erosion have resulted in a loss of tidal marshes and beachfront, threatening habitat and historic resources alike. As sea level rise accelerates, erosion rates and inundation from storms will only increase, exacerbating the loss of critical habitat and natural storm buffers.

5. Problems and Opportunities:

Communities in the vicinity of Little Assawoman Bay are vulnerable to flooding due to wind and rain, as well as tidal effects. Relative sea level is increasing throughout the study area, and will increase the frequency of future flooding. Although the Atlantic Ocean coast is well protected as a result of a significant number of Federal (hurricane and storm damage reduction) projects, the inland bay coasts are not well protected because of a limited number of Federal (flood risk management) projects. As explained previously, Little Assawoman Bay is connected to the Atlantic Ocean through the Indian River Inlet and the Assawoman Canal. In recent years, there has been a significant amount of residential development in the area. Many of the structures are low-lying and built on man-made islands/peninsulas surrounded by water. Flooding and damage to structures occurred in the study area during Hurricane Sandy, and the risk of similar damaging storm events is expected to increase in the future.

6. Plan Formulation:

This initial appraisal of Federal interest was performed in accordance with Appendix F (Amendment #2) of the Planning Guidance Notebook (ER-1105-2-100). This study involved reviewing existing available information, communicating with local government officials, generating alternative solutions, and conducting an economic analysis to determine the feasibility of proposed flood risk management projects in the Delaware Bayshore area. Both structural and non-structural solutions were evaluated.

Initially, the PDT reviewed the results of the North Atlantic Coastal Comprehensive Study (NACCS), and the ongoing Dredged Material Utilization Study (DMU). The NACCS provided an array of sites in the Delaware Bayshore region, as well as related technical information. The DMU screened sites for beneficial uses of dredged material. The PDT evaluated sites that were screened out for beneficial use, but may have potential for flood risk management. The PDT also participated in conference calls with representatives from Delaware Department of Natural Resources and Environmental Control (DNREC). This coordination solicited input on problem areas, priority sites, historical flooding and damages, etc. Eight sites were selected for further screening based on the original screening using information from NACCS, DMU, and DNREC coordination. The eight sites selected were: Fenwick Island, Dewey Beach, Delaware City, Mallard Lakes, Joy Beach, Long Neck, Oak Orchard, and Milford. (Figure 1). These eight sites were evaluated using the HAZUS flood model for the 10-year and 100-year return periods. The eight sites were also evaluated using a parcel-based GIS analysis.

Based on all the available information, coordination, screening, and the presence of numerous structures within high frequency flooding areas (10% ACE event), it appeared that Fenwick Island and Mallard Lakes (Figures 3, 4) were the most promising sites to carry forward for further investigation in the FID study phase. Mallard Lakes and Fenwick Island both sustained damages during Hurricane Sandy. Mallard Lakes (located in Selbyville, DE) is a large condominium complex comprised of nearly 500 units. Flooding during the Hurricane Sandy event caused significant flooding damages to at least 24 condominium units within the complex. The damaged buildings were constructed on a man-made island encircled by tidal water. Mallard Lakes has similar characteristics to Fenwick Island and other sites in the Little Assawoman Bay area. Therefore, the PDT decided to focus on the Mallard Lakes as an example potential site for this FID report. The results of the Mallard Lakes analysis may be applicable in the future to other sites in the (Little Assawoman Bay) study area, as well as the larger Delaware inland bay region

Mallard Lakes
(Aerial View)
Figure 3


Mallard Lakes
(Profile View)
Figure 4

7. Alternative Plans:

Both structural and non-structural measures were considered for all of the potential sites during the screening process. Structural measures include: seawalls/revetments, berm/levees, floodwalls/bulkheads. Non-structural measures include acquisition/buyouts, flood warning systems, elevation of structures, and flood proofing techniques. Flood proofing techniques fall into two categories: (1) dry flood proofing—prevents floodwaters from entering a structure, (2) wet flood proofing—allows floodwaters to enter a structure, but minimizes the damage.

Many of the inland bay sites evaluated during the plan formulation and screening process were subject to tidal flow and surrounded by bodies of water. The Fenwick Island site, for example, was laid out with multiple peninsulas populated by numerous private boat slips. The PDT concluded that it was not feasible to construct an extensive line of hard structures (i.e. structural measures) to protect the properties from flooding. Mallard Lakes, however, consists of structures concentrated together on man-made islands. These structures were among the most heavily damaged buildings during Hurricane Sandy.

The PDT concluded that Mallard Lakes had a significant need for flood protection (to 100-year or ACE probability of 1%), and the most probable solution was a non-structural measure, "elevation" – i.e. raising of the structures. Implementing this alternative would reduce the risk of storm damage to property and the related issues of public health and safety. This alternative was not expected to result in any major environmental impacts. Impacts associated with the construction process, such as noise and air quality issues, would be temporary in nature. Any impacts from detailed design features considered during the feasibility study phase would be fully evaluated in the associated NEPA document.

8. Economic Assessment:

The economic assessment for the FID study phase examined the potential economic benefits of constructing a flood risk management project that would reduce flood risk to public health, safety, and property in the Little Assawoman Bay area. A representative structure was chosen in Mallard Lakes, Selbyville, DE as this community has had repetitive, historic damages associated with flooding from storm events. This assessment followed USACE guidelines for estimating National Economic Development benefits as contained in ER 1105-2-100, *Planning Guidance Notebook*, Appendix E, Section III – Flood Damage Reduction. All benefits and costs were estimated in average annual terms. All costs and benefits were calculated in fiscal year (FY) 2016 price levels, annualized applying a 50-year period of analysis, and the FY16 interest rate of 3.125%. All benefits and costs are based upon the representative structure at Mallard Lakes.

Project Costs

The project construction cost and annual costs of the proposed improvement plan (structure elevation), as designed to protect for the 1% Annual Chance Exceedence (ACE) event, are shown in *Table 1*. The project cost analysis used Parametric Cost estimates outlined in the *North Atlantic Coast Comprehensive Study* (NACCS) *Appendix C: Planning Analyses*. The cost of the project over a 50-year period of analysis was annualized.

Table 1 – Non-Structural Solution Cost Estimate

Elevation (bldg. retrofit) - Construction Quantities & Costs

Item	Number	Unit	Unit Cost	Value
Costs per sq.ft	4,500	sq.ft.	$88	$396,000
Temporary Re-housing	4	ea	$10,000	$40,000
Subtotal				$436,000
Contingency	25%			$109,000
Total Construction				$545,000
E&D	$10,000			$10,000
S&A	10%			$54,500
Total Estimated First Construction Cost				$609,500
Annualized First Costs				$24,254
O&M	N/A			$0
Total Estimated Annual Average Cost				$24,254

Total Estimated First Construction Cost for this 4,500 sq.ft. (multi-unit) structure is $609,500 with an approximate $135 cost per sq.ft. The AAC is estimated at $25,000. Approximately 24 structures could be elevated based on the total cost of $609,500 per structure and the CAP Federal project limit of $10,000,000.

Project Benefits

The primary categories of benefits for this project are structural inundation damages and content damages. This analysis focused only on physical damage, not included are potential non-physical damages such as Income Loss, Emergency Costs, or Transportation Delay Costs. Historical damages indicate that, according to the Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP) Loss Statistics Report, there have been 58 claims filed since 1978.

To supplement the historical damage data, benefits were also based on expected annual damages prevented. Improvement Values were used to estimate Depreciated Replacement Values for the structures as outlined under IWR Report 95-R-9, *Procedural Guidelines for Estimating Residential and Business Structure Value for Use in Flood Damage Estimations*, dated April 2005.

First Floor Elevation was estimated for the representative structure in Mallard Lakes, Selbyville, DE using a LiDAR (Light Detection and Ranging) derived Bare Earth Digital Elevation Model acquired from the U.S. Geological Survey (USGS). (Figure 5)

Figure 5 – Mallard Lakes Elevation Range

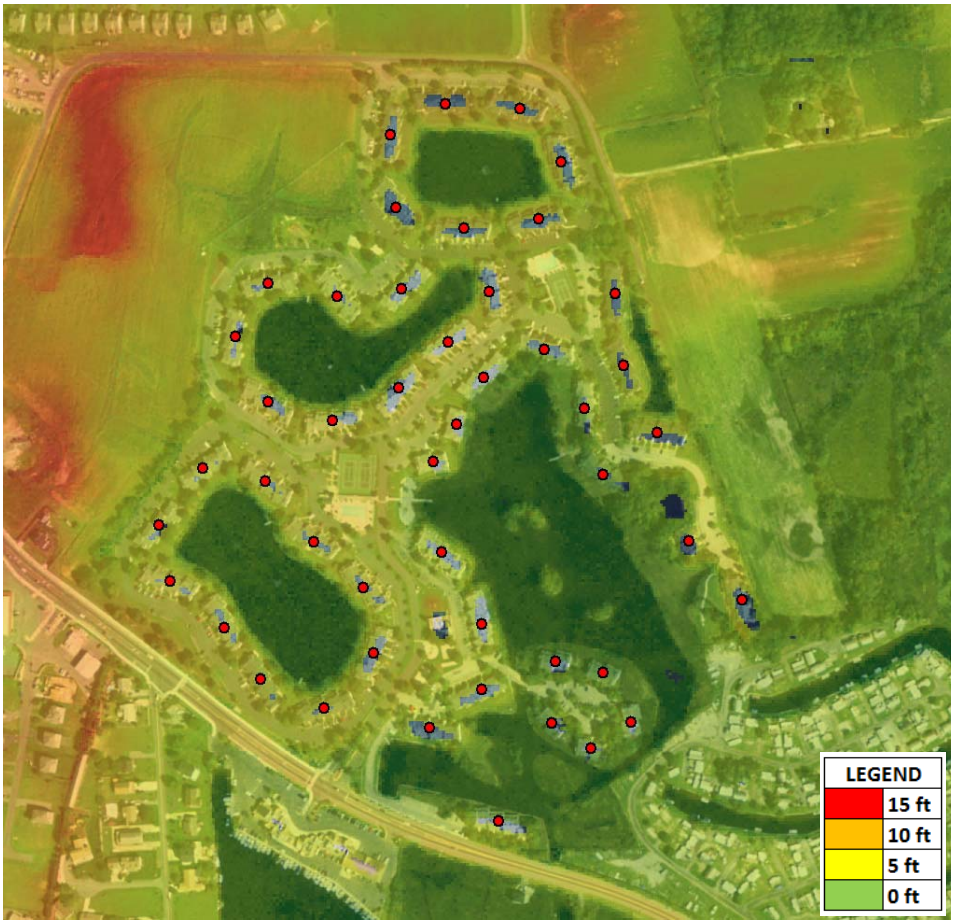

Table 2: Mallard Lakes - Damage-Frequency Curve - Structures

Frequency (Year Event)	Frequency Interval	Damages	Average Damages	Weighted Damages
500		$247,728		
	0.008		$230,220	$1,842
100		$212,713		
	0.010		$197,461	$1,975
50		$182,208		
	0.020		$171,425	$3,429
25		$160,643		
	0.060		$155,153	$9,309
10		$149,664		
	0.900		$74,832	$67,349
1		$0		
$83,903				

Total Average Annual Damages for the representative structure are approximately $84,000.

Content damages were added using a content-to-structure value ratio. As no residential site-specific surveys for content-to-structure damages are available, as outlined in ER 1105-2-100 *Planning Guidance Notebook*, a generic content-to-structure ratio was used to estimate content damages in inundated structures. EM 1110-2-1619, *Risk-Based Analysis for Flood Damage Reduction Studies*, was used to apply the generic content-to-structure ratio.

Table 3: Mallard Lakes – Damage-Frequency Curve – Contents

Frequency (Year Event)	Frequency Interval	Damages	Average Damages	Weighted Damages
500		$109,248		
	0.008		$101,527	$812
100		$93,807		
	0.010		$87,080	$871
50		$80,354		
	0.020		$75,599	$1,512
25		$70,843		
	0.060		$68,423	$4,105
10		$66,002		
	0.900		$33,001	$29,701
1		$0		
$37,001				

Total Average Annual Damages for contents are approximately $37,000.

Benefit-Cost Analysis

The proposed non-structural alternative (elevation), using a representative, multi-unit structure in Mallard Lakes, Selbyville, DE, has a BCR of 4.9 with Total Annual Net Benefits estimated at $94,000. A structure inventory map for Mallard Lakes is provided in Figure 6.


Mallard Lakes
Structure Inventory Map
Figure 6
Legend
Mallard Lakes Structures
Mallard Lakes Structure Footprint
10% ACE Flood Event
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9. Study Findings:

This Federal Interest Determination had identified at least one potential solution to reduce the bayside flooding risk to public health, safety, and property in the Little Assawoman Bay & Vicinity area of Sussex County, DE. The economic analysis of the identified alternative (structure elevation) has resulted in a benefit-to-cost ratio that was greater than one.

10. Recommendations:

It is in the Federal interest to pursue a feasibility study for flood risk management in the Little Assawoman Bay & Vicinity area. The study should be performed under the authority of CAP Section 205.

11. Independent External Peer Review (IEPR):

At this initial level of investigation, it will be assumed that Type 1 IEPR will not occur. Upon continuation of the feasibility study and further gathering of information, a risk-based decision analysis will be prepared to determine whether or not IEPR is applicable. Should it be concluded that IEPR is not applicable, a waiver will be requested at that time.

12. Views of the Non-Federal Sponsor:

It is anticipated that the non-Federal sponsor will be the Delaware Department of Natural Resources and Environmental Control (DNREC), Sussex County or some combination thereof. Further coordination with the potential non-Federal sponsors will occur during development of the Project Management Plan and negotiation of the Feasibility Cost Share Agreement. A letter of support from DNREC is provided in Figure 7.

13. Views of Federal and State Agencies and Interested Organizations:

The views of Federal and state agencies will be solicited during the Feasibility Phase.

14. Conclusion/Determination of Federal Interest:

Based on the economic analysis provided in Section 8 of this report, there are sufficient benefits to warrant Federal interest in the continuation to a feasibility study. In order to proceed with the study, the Federal government and a non-Federal sponsor will need to execute a Feasibility Cost Sharing Agreement (FCSA), which will designate the funding responsibilities for completion of the study. The costs of the feasibility study would be cost- shared 50%/50% between the Federal government and the non-Federal sponsor. If the final analysis indicates that the Federal participation in construction is feasible and in the Federal Government's interest, the Government will seek to enter into a Project Partnership Agreement (PPA) with a non-Federal sponsor, and seek cost shared funds for project design & implementation at 65%(Federal)/35%(non-Federal).

15. Milestones:

In accordance with the June 12, 2014 memorandum from North Atlantic Division, the table below provides a milestone schedule for the feasibility study.

Table 4 - Milestone Schedule

Milestone	Schedule (Day-Month-Year)
CW080-FCSA Submittal to MSC	1 September 2016
CW090-FCSA Approval	1 August 2016
CW130-FCSA Execution	1 November 2016
CW150-Draft Feasibility Report Submittal to MSC	1 December 2016
CW150-Final Feasibility Report Submittal to MSC	1 May 2017
CW170-Feasibility Report Approval	1 July 2017

Figure 7 – Letter of Support from DNREC

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES
AND ENVIRONMENTAL CONTROL
DIVISION OF WATERSHED STEWARDSHIP
89 Kings Highway
DOVER, DELAWARE 19901

OFFICE OF THE
DIRECTOR

PHONE: (302) 739-9921
FAX: (302) 739-6724

December 13, 2013

Peter R. Blum, P.E.
Chief, Planning Division
U.S. Army Corps of Engineers
Wanamaker Building
100 Penn Square East
Philadelphia, Pennsylvania 19107

Reference: Request for Assistance for Areas Impacted by Hurricane Sandy

Dear Mr. Blum:

This letter requests assistance from the U.S. Army Corps of Engineers (Corps) under the Continuing Authorities Program (CAP). Specifically, we are requesting assistance in evaluating alternatives for flood risk management to prevent future flood damage in these impacted communities. We understand that if the Corps determines there to be a Federal interest, a non-Federal sponsor must agree to cost-share the feasibility study and construction.

The study area was severely impacted by Hurricane Sandy and is best described as low lying areas along the Delaware River and Bay in New Castle County, Kent County and Sussex County Delaware and low lying areas along the Sussex County Inland Bay Shorelines (Assawoman Bay, Indian River Bay and Rehoboth Bay.)

Hurricane Sandy produced storm surge flooding in these areas causing flood damage to numerous residential structures. In the hardest hit areas, water levels approached 100 year (1% annual chance) levels and caused "substantial damage" to many buildings. Post-Sandy surveys of impacted areas, and subsequent project development efforts, resulted in the identification of numerous flood damage reduction, and environmental restoration projects which exceed the amount of funding available.

We look forward to working with you in the future. We understand that a meeting concerning these impacted areas has been scheduled from January 8, 2014 in the Dover, Delaware area and would like to discuss the Continuing Authorities Program at that time. Our point of contact for this request is Michael S. Powell and he can be reached at (302) 739-9921

Sincerely,

Michael Powell
Environmental Program Manager

Cc: Ms. Jane Jablonski, USACE
Tony Pratt, Delaware DNREC

Delaware's good nature depends on you!