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Independent External Peer Review of the New Jersey Beneficial Use of Dredged Material for the Delaware River Feasibility Report and Integrated Environmental Assessment

Final Report

9 March 2018

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Prepared for: Department of the Army
U.S. Army Corps of Engineers
Coastal Storm Risk Management Planning Center of Expertise
Baltimore District

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Executive Summary

This Final Report provides the results of an Independent External Peer Review (IEPR) of the documents associated with the *New Jersey Beneficial Use of Dredged Material for the Delaware River Feasibility Study and Integrated Environmental Assessment* (NJ BUDM FS/EA). The Philadelphia District of the U.S. Army Corps of Engineers (USACE) is conducting the NJ BUDM FS/EA.

Project Background

The purpose of the NJ BUDM FS/EA was to analyze coastal storm risk management issues in various New Jersey communities on Delaware Bay with the intent to use dredged material from federal navigation channels within the Delaware River and Bay for beneficial purposes.

The Tentatively Selected Plan was to use dredged material for beach nourishment and to construct dunes at three locations along the southern New Jersey shoreline of Delaware Bay. These locations are Gandy's Beach, Fortescue Beach, and Villas Beach.

Independent External Peer Review

The LMI Team, consisting of Logistics Management Institute (LMI) and Analysis Planning and Management Institute (APMI), conducted an IEPR of the NJ BUDM FS/EA. The IEPR Panel (the Panel) was charged with reviewing specific project-related documents and providing a broad technical evaluation of the analyses and material contained in those documents. The review was conducted to analyze the adequacy and acceptability of methods, modeling, data, and analyses used. The IEPR focused on a technical review and did not involve policy review, and was conducted in accordance with the procedures described in USACE Engineer Circular No. 1165-2-214, *Civil Works Review*, dated 15 December 2012, as amended in Engineering and Construction Bulletin 2016-9, dated 4 March 2016.

Summary of the IEPR Results

The Panel reached consensus on their assessment of the adequacy and acceptability of the economic, engineering, and environmental methods, models, and analyses used in the reports. The following paragraphs summarize by discipline the results of this IEPR.

Plan Formulation/Economics

The project formulation analysis as presented in the NJ BUDM FS/EA was extensive and sound in most cases. The analysis considered numerous alternatives and provided sound reasoning for eliminating various alternatives during early stages of formulation/evaluation. However, there is one important aspect that was not accomplished, and no reasoning was provided for its omission. A National Economic Development (NED) Plan, required by Engineer Regulation 1105-2-100, was not specifically identified in the documentation. The net excess benefits over costs were increasing for all alternatives. If a NED Plan cannot be identified, reasons must be discussed in the report.

The economic analysis provided adequate detail for the assumptions and data used in the models, and the analysis was presented in a form that was easy for the reader to follow. However, an NED Plan must be identified before the NJ BUDM FS/EA can be finalized.

Biological Resources and Environmental Law Compliance

The NJ BUDM FS/EA document adequately summarizes such previous studies as the North Atlantic Coast Comprehensive Study: Resilient Adaptation to Increasing Risk (NACCS), specifically as it relates to the guidelines and limitations authorized by the 26 October 2005, resolution of the Committee on Environment and Public Works of the United States Senate and the Disaster Relief Appropriations Act, 2013 (Public Law 113-2). However, several important issues need additional attention, discussion, and explanation.

The technical impact analyses in the environmental assessment were performed without coordination with many resource agencies. Although the main impacts have been identified, some issues still need to be resolved. A significant issue is that the NJ BUDM FS/EA is not yet environmentally compliant. It was published before developing an NED Plan, which would include the optimization of specific alternatives. The NED Plan optimization may change the identified impacts. Until the coordination with and response to the resource agencies has been completed and any changes that may occur during the NED Plan have been addressed, the report does not in its present form meet the procedural requirements of the National Environmental Policy Act. Also, Appendix D lacks an alternative analysis as required by Section 404(b) of the Clean Water Act.

The NJ BUDM FS/EA also does not clearly state the project's purpose and need. The report should explain why it only discusses the use of dredge material, why USACE chose to use the NACCS continuing eligibility inspections screening tool, and how these issues affected the alternatives analysis. The discussion should cover the specific authorization limitations, how these limitations have affected the analysis of alternatives, and what the next steps are in the planning process. Clarification would allow the reader to better understand the overall focus of this report.

Civil/Design Engineering

The Panel recognizes the significant effort involved in developing this flood mitigation program. The Panel notes a few shortcomings in civil/design engineering that should be addressed, such as the criteria used for site selection, modeling, dune design, constructability, and design top elevations.

The Panel understands that the decision by Congress restricting the project to using only dredge material means that other possible options could not be considered, however, this is not clearly explained in the NJ BUDM FS/EA. The report should describe why other possibly more cost-effective alternatives were not considered and included in this project, such as purchasing, demolishing, or moving affected properties to higher ground or implementing warning and alarm systems. Because many other sites are probably also ready for improvement, some explanation should be provided to support the selection of only three sites for this project and to indicate what will be done for the sites that were not selected.

In an area with significant year-round navigation traffic, more information should be provided on how the construction schedule will be laid out to minimize potential adverse shipping impacts and to accommodate dredge material availability. Any shipping business impacts should be identified and mitigated.

More information should be provided on the proposed beach and dune elevation and designs. The report does not describe why the dredged material is suitable for beach and dune construction, factors

such as appropriate composition for beach nourishment and constructing dunes, compatibility with receiving area material, potential for erosion of placed material, and the level of contamination of the dredged material.

The NJ BUDM FS/EA should provide more detailed explanations on how mathematical models, such as Beach-fx and riverine models, were used in the design of new dunes and groins and on the accuracy and adequacy of the results for making decisions at the feasibility stage. The report does not describe why a beach elevation of elevation level (EL) +5 was selected and why both a beach and a berm were selected for Villas Beach.

More details should be provided on the possible effects of wave radiation on nearby sites resulting from the new dunes and groins. New dunes will likely restrict stormwater flows, but the report does not discuss whether additional or enlarged outfalls will be needed in the dunes to release stormwater that accumulates behind the dunes. The NJ BUDM FS/EA does not describe how the proposed beach and dune structures would perform during severe storm events such as hurricanes and nor'easters or extreme events such as a tsunami, nor does it state how much protection the new dunes would provide.

Coastal Engineering

The intent of the actions proposed in the NJ BUDM FS/EA to beneficially use dredged material from federal navigation channels within the Delaware River and Bay and to recommend measures to manage and reduce risk from coastal storms. Considering that it is a feasibility study, the key issues have been discussed and realistic assumptions and applicable approaches have been considered. The hydrology and hydraulics report is well written and the format is easy to follow.

That said, the NJ BUDM FS/EA should include some necessary information and clarifications on the assumptions and values utilized in the study. For example, Appendix C1 does not provide information on the sediment budget for the study areas, and it does not discuss the impact of proposed groins on the down-drift estuaries and environmentally sensitive areas. The land subsidence for the project areas and its consideration in sea-level change (SLC) needs more discussions. The infrastructure information and structure inventory for the project areas that were used in the Beach-fx model are not clearly discussed and defined. More discussion should be provided on why more detailed coastal analysis with local settings was not utilized. The main body of the NJ BUDM FS/EA does not discuss or evaluate the potential for secondary inundation resulting from flooding of the marshland or streams on the landward side of the various communities.

Geotechnical Engineering

The geotechnical analysis of the sediment available for use in beach nourishment is well described in the NJ BUDM FS/EA. The analysis makes it clear that the sediment in Reach E of the Delaware Bay is the appropriate grain size and material type for use in beach nourishment on the New Jersey shore. Past disposal of the same sediment type at the offshore Buoy 10 site implies that mining of sediment from the Buoy 10 site may also be a source for the initial beach nourishment activity.

The NJ BUDM FS/EA lacks analysis to assess the impact of primary consolidation settlement on the volume of nourishment required for the initial construction of the proposed beach profile. Significant primary consolidation settlement is likely where sand overlies much more compressible sediment

deposited in the Delaware River estuary. High land subsidence rates from the secondary compression of these sediments, as noted in published references, confirms that primary consolidation settlement losses in the proposed beach nourishment profile could be significant to the feasibility of the project.

The analysis of means and methods to place the sediment by long-line pumping in a large open bay that is likely to experience high wave conditions is also a concern. The report should consider alternates to the placement method that would obviate the impacts of open sea conditions on the beach nourishment placement.

Hydrology and Hydraulic Engineering

The NJ BUDM FS/EA covers a broad range of issues that are expected to affect the project sites with respect to hydraulics, including coastal processes and SLC. There are three issues for which additional detail should be provided: 1) upland/creek/backbay flooding, 2) sediment transport impacts resulting from the proposed project, and 3) relative SLC. Additional discussion of upland, creek and/or backbay flooding is important to the overall success of the project because the proposed project has the potential to exacerbate flooding behind the proposed improvements. This is evident from a review of the effective Federal Emergency Management Agency Flood Insurance Rate Maps, which suggest insufficient flood capacity. Additional discussion is needed of the impact of the proposed project on sediment transport, considering both overall sediment behavior at the sites and how the proposed structures may impact sediment transport, particularly offsite. Finally, additional discussion should be provided about the details of the SLC analysis, including local geologic trends that partially affect local SLC.

Summary of Panel Comments

Presented below is a summary of the Panel comments. Section 4 of this document contains definitions of comment significance and the complete final comments with explanations and recommendations. This IEPR developed five High, two Medium High, nine Medium, seven Medium Low, and four Low comments.

No.	Panel Comment
Significance: High	
1	It is not feasible in the open sea conditions of the lower Delaware Bay to pump dredged sediment removed from Reach E or Buoy 10 from the Hopper Dredge located near the edge of the navigation channel in a floating pipeline the long distances to Gandy's Beach (30,867 feet [ft.]), Fortescue Beach (41,679 ft.) or Villas Beach (45,877 ft.) (Appendix C3).
2	The effect of primary consolidation of underlying compressible sediment is not incorporated into the feasibility assessment. The additional volume of beach nourishment required to offset primary consolidation is not incorporated into the economic assessment. The potential impacts of settlement on adjacent structures (particularly at Gandy's Beach and Fortescue Beach) have not been assessed to determine feasibility.
3	Numerous pending coordination activities are outstanding as outlined in Table 17 - Summary of Environmental Compliance, page 63.

4 The cost basis for the Tentatively Selected Plan (TSP) is not clear and cannot easily be determined from the report.

5 The report does not describe why upland/creek/backbay flooding was excluded from the analysis, why this type of flooding is not important to the project, or if outfalls will be needed in the dunes to release stormwater that accumulates behind the dunes.

Significance: Medium High

6 No National Economic Development (NED) Plan was identified in this report. Various levee heights are shown for the three areas where projects are recommended, but none bracket the NED plan.

7 The cost analysis for Initial Construction in Appendix C3 is too high for Alternate E. The cost analysis for Initial Construction for Alternate A and B is likely too low for the open water pumping conditions priced.

Significance: Medium

8 The report does not describe how sediment transport was determined for the study, nor is a sediment budget for the project sites provided.

9 The effect of the terminal groins on the down-drift side of the groins is not considered in the report, and the proposed groins will effect sediment movement and cause off-site erosion.

10 The report does not describe how wave radiation effects resulting from the new dunes and groins on nearby sites were considered.

11 Sea Level Change (SLC) should be clarified as "relative SLC", which includes both real SLC and land subsidence. The report does not state how the baseline for SLC calculations was established or describe how geotechnical changes, including land subsidence, were considered in the calculations. Also, only actual SLC has a "climate change component".

12 The report does not explain why the Continuing Eligibility Inspections (CEI) screen tool, which is heavily weighted 80% infrastructure and 20% environmental, was used in the analysis.

13 The ratio of the wave height to the depth is limited to the so called breaker index $(H/d)_b$. Some of the values seem incorrect in Table 7: NACCS [*North Atlantic Coast Comprehensive Study*] Water Level Annual Exceedance Probability and Table 8: NACCS Wave Height Annual Exceedance Probability. In these tables, the ratio of wave height to the depth exceeds the Breaking Wave Height to the Depth Ratio and is not in the range of the routine wave breaking ratio of 0.7 to 0.8.

14 The report does not provide adequate details about the Beach-fx model, such as model calibration and accuracy. Also, the report does not clearly describe how the infrastructure information and structure inventory for the project areas to be used in the Beach-fx model were determined and defined.

15 The report does not describe why a beach elevation of EL +5 was selected and why both a beach and berm were used for Villas Beach.

16 The report does not provide the construction schedule for the projects or discuss the issues and factors that will determine the schedule.

Significance: Medium Low

17 Detailed and local coastal modeling for each site or for the bay might be needed. The report does not provide adequate information about the riverine model used to analyze hydraulics and hydrology issues associated with the project, such as model set up, calibration, and topographic and bathymetric data used in the model.

18 The report does not clearly explain how all the initial candidate sites were analyzed and the three final sites selected.

19 Appendix D – *404(b) Analysis* does not have an alternative analysis.

20 The report does not explain clearly why the TSP only includes beach nourishment and constructing berms and groins. Normally, other options like moving housing and structures to safer, higher grounds are also considered, an alternative based on an inventory of unsafe structures affected by flooding.

21 The report does not explain why warning and alarm systems and other non-structural issues were not analyzed.

22 The report does not discuss how the TSP will protect against historical storms such as Hurricane Sandy, nor'easter storms, and a tsunami.

23 The report does not discuss the contamination status of the dredged material to be used in the project.

Significance: Low

24 The Purpose and Scope (Purpose and Need) does not clearly delineate the rationale for this report, justify why this report was prepared, and explain why it only focused on coastal storm risk management (CSRM) benefits and not protection for erosion of the entire coast line, including the marshes.

25 The current Federal Discount Rate is not used in the study.

26 The definition of "coarse grained material" should be clarified to be 90% or more by dry weight of sand.

27 Units are missing from Table 4: Tidal Datum Relationship, Appendix C1.

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1 Introduction

1.1 Overview

This Final Report provides the results of an Independent External Peer Review (IEPR) of the *New Jersey Beneficial Use of Dredged Material Feasibility Study and Integrated Environmental Assessment* (NJ BUDM FS/EA) and the project's associated documents. The Philadelphia District of the U.S. Army Corps of Engineers (USACE) is conducting this project. The IEPR has been conducted in accordance with the procedures described in USACE Engineer Circular (EC) No. 1165-2-214, *Civil Works Review*, dated 15 December 2012 as amended in Engineering and Construction Bulletin 2016-9, dated 4 March 2016[1].

The USACE lifecycle review strategy for civil works projects provides for a review of project documents from initial planning through the project phases of design and construction, as well as operation, maintenance, repair, replacement, and rehabilitation. The strategy provides procedures for ensuring the quality and credibility of USACE decision, implementation, and operations and maintenance documents in addition to work products. Peer reviews, such as this IEPR, are one of the important procedures used to ensure that the quality of USACE published information meets the standards of the scientific and technical community.

This IEPR has been conducted by a group of independent experts (the Panel) under the auspices of Analysis Planning and Management Institute (APMI) as a subcontractor to the Logistics Management Institute (LMI). In order to assure the independence of the review, both organizations meet the requirements of USACE and the Water Resources Development Act (WRDA) of 2007 as amended in 2014, in addition to EC 1165-2-214, as an Outside Eligible Organization (OEO). Specifically, each of the two organizations has experience in establishing and administering peer review panels, is qualified as an Internal Revenue Code Section 501(C)(3) organization, is an independent science and technology organization, free from conflicts of interest, and does not carry out or advocate for or against federal water resources projects. Both organizations and the Panel for this IEPR have not been involved in any capacity with the current project. Consistent with EC 1165-2-214, OEO is used in this report to represent the combined efforts of LMI and APMI.

1.2 Project Background

The U.S. Congress has directed and authorized USACE to investigate the beneficial uses of dredged material within the Delaware River and Estuary area[2]. The authorization includes conducting a utilization-study reconnaissance phase and any ensuing feasibility-phase investigations. USACE has prepared the NJ BUDM FS/EA under this authority.

USACE dredges approximately 3 million cubic yards of sediment annually from the Delaware River in the Philadelphia-to-the-Sea reach and the Philadelphia-to-Trenton reach. The sediment is removed from

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[1] Engineering and Construction Bulletin No. 2016-9 provides interim civil works review policy for continued use of EC-1165-2-214, which expired in 2014, with the exception of few specific changes from the Water Resources Reform and Development Act of 2014. These changes do not affect the process for conducting Type I IEPRs.

[2] *Senate Resolution on Beneficial Use of Dredged Material on the Delaware River, Delaware, New Jersey, and Pennsylvania* and the *Disaster Relief Appropriations Act, 2013* (Public Law 113-2).

the estuary and placed in confined disposal facilities or nearby open disposal areas. USACE is studying innovative methods to manage and reuse the dredged material to improve flood risk management.

USACE has conducted the *Delaware River New Jersey, Delaware, and Pennsylvania Dredged Material Utilization and Beneficial Use Opportunities Expedited Reconnaissance Study* (the Reconnaissance Study). The purpose of the Reconnaissance Study was to examine beneficial use opportunities using maintenance dredging material from the Delaware River and its tributaries for flood reduction, environmental restoration, and related purposes.

The USACE Reconnaissance Study found that there is a federal interest in additional investigations of opportunities for beneficially reusing sediment for multiple purposes by conducting a feasibility study within the State of New Jersey. Based on a screening of alternatives in the Reconnaissance Study, potential projects were identified within New Jersey that would be consistent with U.S. Army policies regarding costs, benefits, and environmental impacts. The NJ BUDM FS/EA documents the analysis of these projects.

1.2.1 Problem Description and Project Purpose

The primary problems identified in the NJ BUDM FS/ES are that shoreline erosion, waves, and storm surge from coastal storms, along with sea-level change (SLC), cause flood-related damages along the Delaware Bay shoreline of New Jersey. The shoreline is characterized by a flat, low-lying coastal plain with broad marshes and narrow barriers of sand along the bay beaches. The sand beach barrier is widest and most well developed near the mouth of the bay, becoming less prevalent to the north.

The purpose of the NJ BUDM FS/EA was to analyze Coastal Storm Risk Management issues in various New Jersey communities with the intent to use dredged material from federal navigation channels within the Delaware River and Bay for beneficial purposes and to recommend measures to manage and reduce risk from coastal storms.

1.2.2 Site Selection

USACE conducted an extensive analysis of potential sites for using dredged material beneficially to achieve NJ BUDM FS/ES objectives. The sites identified to meet the NJ BUDM FS/ES criteria were Gandy's Beach, Fortescue Beach, and Villas Beach (Figure 1).

1.2.3 Tentatively Selected Plan

The USACE Tentatively Selected Plan (TSP) consists of beach restoration at Villas Beach and beach restoration with groins at Gandy's Beach and Fortescue Beach.

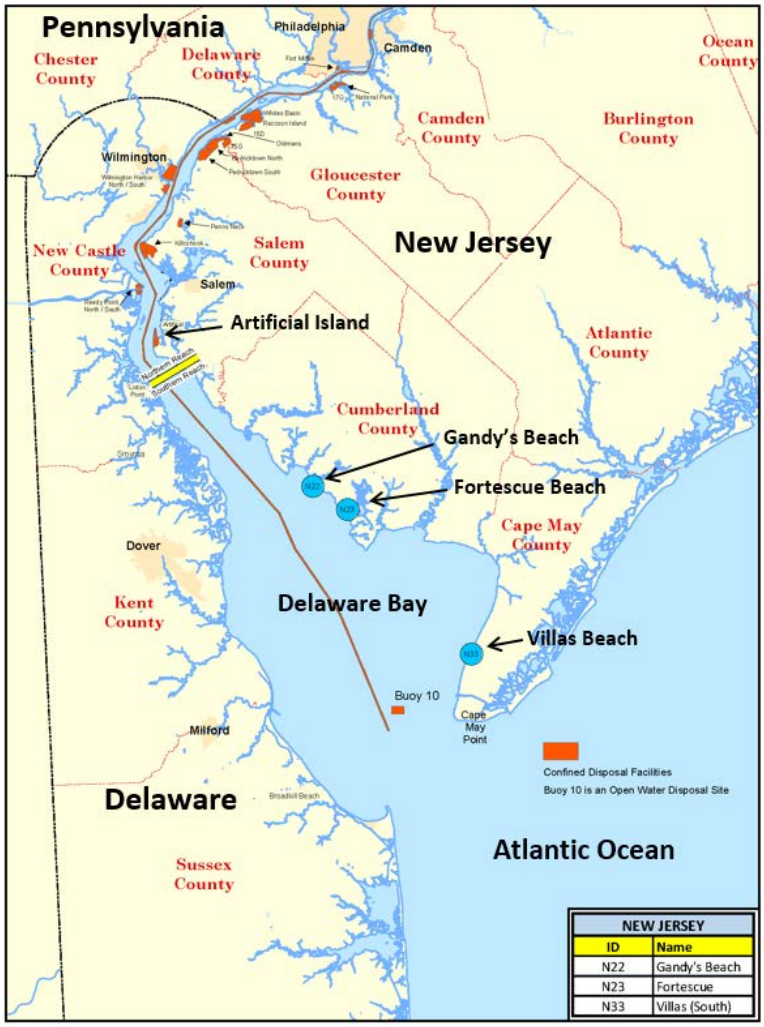

Figure 1: Gandy's Beach, Fortescue Beach, and Villas Beach on Delaware Bay

For Gandy's Beach, the proposed design template features a berm 75 feet (ft.) wide at a height of +6 ft. North American Vertical Datum of 1988 (NAVD 88)[3] with a foreslope length of approximately 130 ft. on a slope of 1V:10H extending bayward to a tie-in depth of -7 ft. NAVD 88 (Figure 2). A new terminal groin structure is proposed for the northern end of the Gandy's Beach footprint to reduce longshore losses of sand from the proposed project area.

At Fortescue Beach, the proposed design template is a berm 75 ft. wide at a height of +6 ft. NAVD 88 with a foreslope length of approximately 100 ft. on a slope of 1V:10H extending bayward to a tie-in depth of -4 ft. NAVD 88 (Figure 2). The existing terminal groin at the northern edge of the community will be repaired and replaced as part of the recommended plan to reduce loss of sand at the end of the groin and the associated frequency required to replenish the sand.

[3] The NAVD 88 is the vertical control datum of orthometric height established for vertical control surveying in the United States of America based upon the General Adjustment of the North American Datum of 1988.

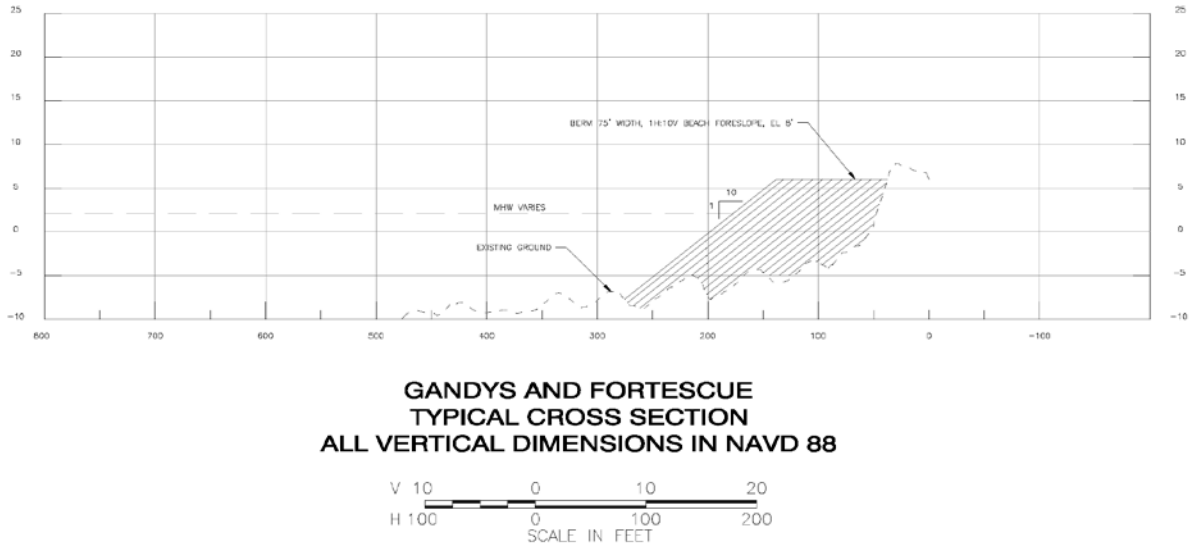

Figure 2: Tentatively Selected Plan for Gandy's Beach and Fortescue Beach

At Villas Beach, the proposed design template is a berm 75 ft. wide at a height of +5 ft. NAVD 88 with a foreslope of approximately 100 ft. length on a slope of 1V:10H extending bayward to a tie-in depth -2 ft. NAVD 88. The berm has a dune on top with a crest width of 25 ft. and a height of +12 ft. NAVD 88. The dune transitions both bayward to the berm and landward to existing grade on a slope of 1V:5H (Figure 3).

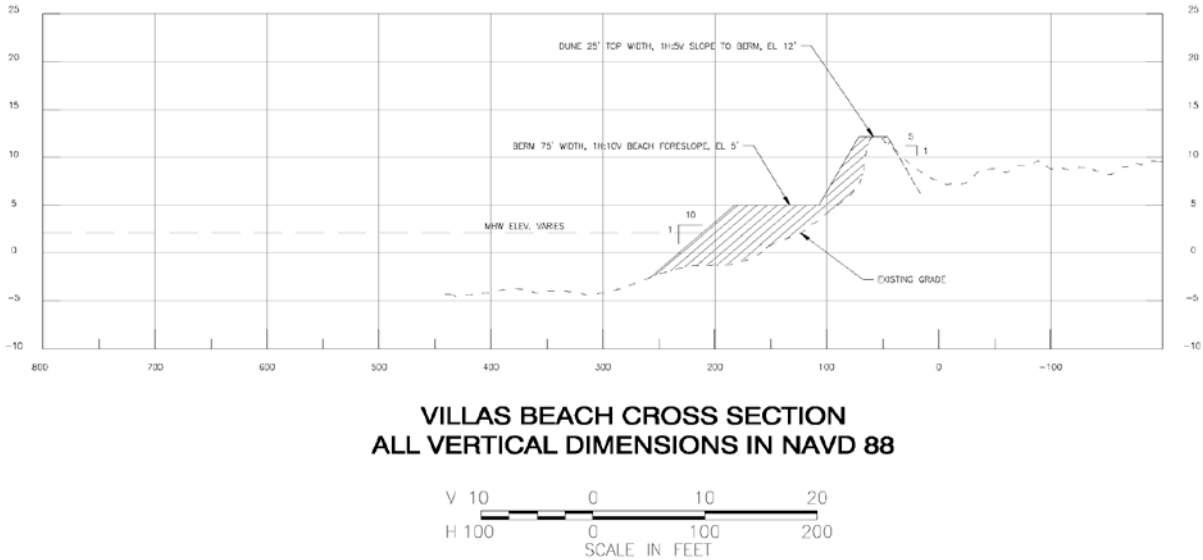

Figure 3: Tentatively Selected Plan for Villas Beach

2 Independent External Peer Review Process

This section summarizes the process for conducting this IEPR. Details of the review were documented in various intermediate work products provided to USACE during the course of this effort.

2.1 Managing the Review

As described in Section 1.1, APMI and LMI meet the requirements of USACE and the WRDA of 2007 as amended in 2014 and EC 1165-2-214 as an OEO. Consistent with EC 1165-2-214, OEO is used in this report to represent the combined efforts of LMI and APMI to conduct the IEPR.

The OEO developed and executed a Work Plan to define and manage the process for conducting the IEPR. The Work Plan described the process for screening and selecting independent reviewers, communicating and meeting with the USACE project team, maintaining the project schedule and quality control, compiling and disseminating the independent reviewers' comments, and project management and administration.

The OEO established an organizational structure for managing the IEPR to assure the independence of the review. This was accomplished by the OEO organizing and mediating all interactions between the Panel and USACE in accordance with the procedures described in EC 1165-2-214.

Figure 4: Organization for Managing the IEPR

2.2 Selecting the Panel

The OEO identified experts who met and exceeded the technical expertise required for this IEPR and then identified any potential Conflict of Interest (COI) issues that potential panel members could have with the project, in accordance with the standards of the National Academy of Sciences (NAS) and Office of Management and Budget M-05-03, *Final Information Quality Bulletin for Peer Review*. The following criteria were considered in the screening of the candidates:

- **Expertise:** Ensuring the selected reviewer has the knowledge, experience, and skills necessary to perform the review.
- **Independence:** Confirming the reviewer was not involved with projects for the New Jersey Beneficial Use of Dredged Material Feasibility Study or in producing the documents to be reviewed.
- **COI:** Identifying any financial or other interest that conflicts with the service of an individual on the Panel because it could impair the individual's objectivity or could create an unfair competitive advantage for a person or organization.
- **Availability:** Assessing the candidates' availability to meet the project schedule.

With this selective candidate determination process, the OEO was able to identify the most qualified candidates who were available to serve on the Panel while ensuring balanced representation of perspectives from academia, industry, and government. Additional details for each Panel Member may be found in Section 3.1 and Appendix A.

2.3 Performing the Review

USACE provided the OEO the documents to be reviewed by the Panel. Table 1 includes the list of the documents used in this review. These documents were then distributed to the Panel along with the charge questions. These charge questions established the general boundaries for the IEPR and served as general guidelines. In addition, the Panel used the charge questions as guidance for identifying relevant information and developing their comments and recommendations. The list of charge questions for this project is located in Appendix B.

Table 1: IEPR Documentation

Documents for Review
Draft Feasibility Report & Integrated Environmental Assessment
Appendix A: Economic Analysis
Appendix B: Real Estate
Appendix C1: Hydrology & Hydraulics
Appendix C2: Civil Design
Appendix C3: Cost Engineering
Appendix C4: Geotechnical Data
Appendix D: 404(b) Analysis
Appendix E: Pertinent Correspondence
Appendix F: Value Engineering Study
Documents for Reference Only
Public Comments
Report Synthesis

The OEO provided the Panel with templates and instructions for preparing their comments to ensure proper coverage of all important issues and consistency in preparing the IEPR comments. The Panel was instructed that the OEO would be the conduit for information exchange between the Panel and USACE throughout the project in order to preserve the independence of the review.

This IEPR involved reviewing the project documentation to analyze the adequacy and acceptability of engineering methods, models, data, and analyses. The review focused on conducting a technical review and did not involve policy issues.

2.4 Developing Comments

After completing the review, individual Panel Members submitted a draft of their comments to the OEO. The Panel comments were collated by the OEO and confirmed as complete and responsive to the charge. Overall themes presented by multiple Panel Members, comments indicating conflicting opinions, and other noteworthy comments were identified. The OEO ensured that the Panel comments focused on performing a technical review of the documents and did not comment on policy-related issues.

Subsequently, the OEO coordinated the Panel to reach consensus on the comments, identify and consolidate any overlapping comments, resolve any contradictions, and finalize the significance rating of all comments. The final comments are included in the Final IEPR Report presented here. Following the guidelines of EC 1165-2-214, the OEO also entered the comments into the Design Review and Checking System (DrChecks)[4] for USACE internal tracking of the Final Panel Comments and recommendations.

[4] Hosted on the USACE's PROJect extraNET (ProjNet), a web service that allows secure exchange of information.

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3 Qualifications and Experience

The OEO assembled a Panel meeting the qualifications set forth by USACE in the Performance Work Statement for the task. The OEO supported and assisted the Panel in carrying out its review and served as the intermediary for communications and information exchange between the Panel and USACE during the IEPR process.

3.1 IEPR Panel Members

Listed in Table 2 are the individual members who participated on the Panel for this IEPR. Panel Members' full qualifications and resumes are located in Appendix A.

Table 2: Summary of Panel Member Qualifications by Discipline for this IEPR

Panel Qualifications		Mr. Timothy Love	Dr. Bolyvong Tanovan	Dr. Nader Mahmoudpour	Mr. Timothy J. Harrington, PE	Dr. David Jaffe	Mr. Jesse McDonald
Experience	Highest Degree	**MS**	**PhD**	**PhD**	**MS**	**Ph.D.**	**MS**
	Years of Experience	**40**	**40**	**25**	**42**	**15**	**50**
	Past Experience with USACE (Direct [D], Indirect [I], and none [N])	**I**	**D**	**I**	**N**	**I**	**D**
Subject Matter Expertise	Biological Resources and Environmental Law Compliance	✓					
	Civil Design/Engineering		✓				
	Costal Engineering			✓			
	Geotechnical Engineering				✓		
	Hydrology and Hydraulic Engineering					✓	
	Plan Formulation/Economics						✓
Safety Assurance Review		✓	✓	✓	✓	✓	✓

Mr. Timothy Love, Biological Resources & Environmental Law Compliance

Mr. Love is a certified professional wetland scientist with extensive experience in wetland identification and delineation. He has comprehensive knowledge of current USACE regulations and permitting issues concerning jurisdictional waters of the United States and an extensive background in data collection, field investigation, document preparation, and agency interface related to wetland delineations, as well as threatened and endangered species evaluations. Mr. Love is also well versed in the coordination of federal permits required under Section 404 of the Clean Water Act, and Section 10 under the Rivers and Harbors Appropriation Act, including mitigation. As an environmental scientist, he prepared the biological section of the Environmental Impact Statements (EISs) for base realignment and helped in the design of all required mitigation under all federal and state permits, such as the Department of Army permits under

Section 404 for the Base Realignment Mine Warfare Center of Excellence, U.S. Navy, Naval Station Ingleside, and Naval Air Station Corpus Christi, Texas. Mr. Love recently retired after nearly 40 years at a major engineering firm, and is an Emeritus Director of the Galveston Bay Foundation, the Immediate Past Chair of the Executive Committee, Co-Chair of the Permits Committee, and a member of the Land Committee.

Dr. Bolyvong Tanovan, Civil/Design Engineering

Dr. Tanovan is a hydraulic engineer specializing in water quality modeling and monitoring, water resource planning, hydropower modeling, and operational planning. He is an expert in river hydraulics, fish passage modeling, watershed modeling and optimization, profile modeling of water surface, and stormwater management. Dr. Tanovan spent more than 45 years in water resources engineering in Switzerland, Laos, Thailand, and the United States. Dr. Tanovan retired from USACE in November 2008, after 26 years of service dedicated to the management of the Federal Columbia River System. While with USACE, Dr. Tanovan led annual operational planning for the 31 major USACE and other treaty dams on the Columbia River System. In this capacity, he maintained regional coordination with federal and non-federal project owners and operators in the Pacific Northwest, managed the Hydropower Analysis Center of Expertise tasked with performing hydropower studies for USACE projects across the nation, and was responsible for hydro projects in several foreign countries. He also served as Chief of the Fish and Water Quality Section, and as a member of the USACE National Water Quality Committee. Dr. Tanovan holds a Master of Science (MS) degree in Civil Engineering and a Doctor of Philosophy (PhD) in Hydrologic Engineering, Federal Institute of Technology, Lausanne, Switzerland, and has been a licensed/registered Professional Engineer (PE) since 1977.

Dr. Nader Mahmoudpour, Coastal Engineering

Dr. Mahmoudpour has a PhD and a PE registration as a civil engineer. He has more than 24 years of experience as a water resources engineer conducting hydrologic and hydraulics analyses for riverine systems and for two-dimensional hydrodynamic storm surge, waves, and sediment transport modeling. He has provided technical expertise for Federal Emergency Management Agency (FEMA) flood hazard risk analyses for riverine and coastal studies for many miles of riverine and coastal shoreline. He has experience in stormwater management analysis and design; in National Pollutant Discharge Elimination System (NPDES), Total Maximum Daily Load (TMDL), and Municipal Separate Storm Sewer System (MS4) requirements; and watershed studies utilizing Geographic Information System (GIS) applications. He has thorough knowledge of near-shore coastal processes including refraction/diffraction analysis, run-up, littoral transport, shoaling, and beach erosion. He has served on a variety of water resources projects in transportation, water supply, bridge hydraulics and scour analysis, and sewer system design and construction.

Dr. Mahmoudpour provided technical assistance on wave damage functions for the USACE Coastal Storm Damage Prevention Research and Development project, and was a lead engineer for the *Limit of Moderate Wave Action Operating Guidance* and *Primary Frontal Dune Best Practices* documents prepared for FEMA. He co-presented at the Ocean Studies Board meeting on the topic, "Developing a Coastal Impact Factor to Assess Hurricane Intensity for the Ocean Studies Board," Board on Atmospheric Sciences and Climate, National Research Council, NAS, March 2013.

Mr. Timothy J. Harrington, PE, Geotechnical Engineering

Mr. Harrington is a registered PE in the states of Indiana, Michigan, Illinois, Wisconsin, and California, previously holding registration in both New Jersey and Delaware. He obtained his MS in Geotechnical Engineering from Michigan State University and has 42 years of experience in both geotechnical engineering and marine construction. In addition to 22 years as an independent consultant, Mr. Harrington spent time employed with D'Appolonia Consulting Engineers of Pittsburgh, Pennsylvania, Canonie Environment, and Rust Remedial Construction. He has provided geotechnical engineering designs and implemented many USACE and private client geo-construction efforts throughout his career. He is familiar with USACE construction practices, including the deepening of harbors, nourishment of beaches, maintenance of river channels, and removal of contaminated sediment. He has participated in a previous USACE IEPR review for the Cat Island Facility in Green Bay Harbor, which used maintenance dredging to reconstruct wave-attenuating islands that formerly existed in Green Bay prior to the settlement of underlying harbor sediment. He also participated in a USACE *Value Engineering Study* for removal of the remaining sediment in Waukegan Harbor in 2006.

Dr. David Jaffe, Hydrology & Hydraulic Engineering

Dr. Jaffe was chosen primarily for his extensive experience in using numerical models for coastal and riverine analysis, both commercial and proprietary. Dr. Jaffe's modeling experience includes significant use of modeling packages from federal agencies, the USACE Hydraulic Engineering Center (HEC) in particular. This work included analysis, design, and related regulatory elements. Dr. Jaffe has focused his technical expertise on the translation of engineering science into actionable environmental benefits, including protection, restoration, and remediation. His areas of technical focus are hydrology, hydraulics, and sediment transport. Dr. Jaffe utilizes a broad scope of numerical and analytical methods, including a wide range of numerical models, and is an expert in applying existing, off-the-shelf tools to provide in-depth and forward-looking analysis and insight to solve complex hydraulic problems.

Dr. Jaffe has maintained his academic and research ties and currently serves as a lecturer in civil and environmental engineering analysis and design. Additionally, his current area of research focuses on using sediment transport, through modeling and measurement, as a proxy for several facets of environmental analysis and design. Dr. Jaffe's background in physical marine science, riverine hydraulics, and numerical modeling provides a broad foundation for developing solutions in a diverse pallet of aquatic habitats, including those at the intersections of littoral and riverine systems. Dr. Jaffe also manages projects and programs that deal with environmental policy and systematic risk. These projects and programs include large or regional government projects and small, locally driven initiatives covering a broad spectrum of agencies and interests. Dr. Jaffe has served as a project manager for federal and state projects, in particular those of FEMA, the National Marine Fisheries Service (NMFS), USACE, the U.S. Environmental Protection Agency (USEPA), and the U.S. Bureau of Reclamation (USBR).

Mr. Jesse McDonald, Plan Formulation/Economics

Mr. McDonald holds Bachelor of Science (BS) and MS degrees in Agricultural Economics from Mississippi State University and an MS degree in Urban and Water Resource Planning from Georgia Tech. He spent 31 years with USACE conducting, reviewing, supervising, and managing economic and financial analyses on an assortment of water resource development projects. During this time, he had extensive experience in the economic analyses of agricultural and urban flood control, shallow- and deep-draft

navigation, and agricultural water supply projects. His broad experience and training in a wide array of water resource development projects provide him with the ability to link hydrology and economics and to quickly identify any possible weaknesses in the analyses. Mr. McDonald retired in January 2000 and since then has been involved as a consultant in the economic analyses of numerous water resource projects, providing expertise in cost allocation, financial analyses, and the analysis of environmental preservation/restoration projects.

3.2 OEO Key Personnel

The OEO consisted of the following members:

Doug Wheeler, PMP, CCP, RMP, Program Manager (LMI)

Mr. Wheeler is an industrial and mechanical engineer with more than 20 years of experience in strategic process engineering and financial analysis, including work for USACE, the Department of Energy (DOE), and the General Services Administration (GSA). For USACE, he led a consultant and client team in a business process reengineering effort for the Navigation Locks and Dams High-Performing Organization. He also led project teams in a variety of tasks to provide reengineering services to the USACE information technology function. He led the review of the USACE McClellan-Kerr Arkansas River Navigation System maintenance activity and supported the USACE Inland Marine Transportation System. Because of this work, Mr. Wheeler understands USACE's water navigation business area and supporting projects. He has also focused on real property and lease-related projects for GSA as well as economic assessments of infrastructure projects for DOE. Mr. Wheeler will apply LMI's COI process by reviewing each Task Order Performance Work Statement with LMI's management team. LMI's process ensures that each LMI business unit manager is aware of Task Order scope and can raise organizational COI issues before LMI responds. He currently is focused on LMI's project cost engineering practice, privatization, and competitive sourcing services. Mr. Wheeler holds a Masters in Business Administration and a BS in Mechanical Engineering from Columbia University and an MS in Industrial Engineering from Arizona State University.

Ahmad Faramarzi, PE, PMP, Project Manager (APMI)

Mr. Faramarzi supervised project personnel and communicated policies, procedures, and goals to the IEPR team. In coordination with Mr. Wheeler, Mr. Faramarzi maintained regular contact with USACE and was responsible for the overall project plan, project performance, and client satisfaction on this as well as future tasks for USACE. He also had multiple technical and administrative staff as direct reports. Mr. Faramarzi is a registered PE and a Certified Project Management Professional with 36 years of experience providing managerial and technical expertise to private sector and government clients, including USACE, Office of the Secretary of Defense, the U.S. Army, the U.S. Air Force, and the Defense Nuclear Facilities Safety Board. He has organized and managed several important and highly visible standing expert panels in response to recommendations by the NAS. Mr. Faramarzi has a Post-Masters applied scientist/engineer degree from the George Washington University in Aerospace and Mechanical Engineering (fluid mechanics), an MS in Thermofluid Engineering from Northeastern University, and a BS in Nuclear Engineering for Oklahoma University. He has extensive experience with nodal and multi-dimensional fluid flow models, and is on the Board of Directors of the Washington, DC, Section of the American Society of Mechanical Engineers and an active member of the Fluid Dynamics branch.

Dr. Wade Smith, Task Leader (APMI)

Dr. Smith is an ecologist and environmental scientist who received his PhD in Environmental Engineering Sciences from the University of Florida. He has over 30 years of experience with environmental regulations, including the National Environmental Policy Act (NEPA) process, and with analyzing the environmental impacts of many types of federal projects. Examples include dredging and dredged material disposal, offshore oil and gas exploration and production, domestic and industrial wastewater disposal, the operation of electric power generating stations, the construction and operation of coastal recreational developments, pipeline construction and operation, realignment and re-stationing of military forces, closing of military installations, operation of chemical munitions destruction facilities, and dismantling of chemical warfare agent production facilities. Dr. Smith is experienced in working on scientific and engineering issues involving complex and controversial projects. He has prepared programmatic and site-specific EISs, Environmental Assessments (EA), and subject-specific environmental analyses. Dr. Smith has been responsible for all elements of analysis of the physical, biological, and socioeconomic environments. He has participated in all NEPA phases: scoping, draft EIS, public hearings, response to public comments, final EIS, and record of decision. Dr. Smith has also prepared NEPA and environmental analysis guidance documents to be used by federal environmental managers and planners.

Barbara Batson, Project Coordinator (APMI)

Ms. Batson has over 20 years of experience with project management and facilitation with government and corporate clients where she was responsible for ensuring that project quality was maintained and that schedules were completed on time. She has worked on projects for the Department of Defense, Department of Education, U.S. Treasury, Social Security Administration, and DOE. Her project responsibilities included managing global projects with aggressive schedules and facilitating team members on multiple continents. Her experience with project management ensured that the project stayed on schedule and all milestones were met.

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4 Panel Comments

The Panel completed a detailed independent technical review of the NJ BUDM FS/EA and associated documents prepared by the USACE Philadelphia District. The process included reviewing economic, engineering, and environmental issues, models, assumptions, and calculations, and assessing the environmental studies documenting potential project impacts.

4.1 Summary of Comments

The following paragraphs provide a summary of the Panel comments in specific subject matter areas.

Plan Formulation/Economics

The project formulation analysis as presented in the NJ BUDM FS/EA was extensive and sound in most cases. The analysis considered numerous alternatives and provided sound reasoning for eliminating various alternatives during early stages of formulation/evaluation. However, there is one important aspect that was not accomplished, and no reasoning was provided for its omission. A National Economic Development (NED) Plan, required by Engineer Regulation 1105-2-100, was not specifically identified in the documentation. The net excess benefits over costs were increasing for all alternatives. If a NED Plan cannot be identified, reasons must be discussed in the report.

The economic analysis provided adequate detail for the assumptions and data used in the models, and the analysis was presented in a form that was easy for the reader to follow. However, an NED Plan must be identified before the NJ BUDM FS/EA can be finalized.

Biological Resources and Environmental Law Compliance

The NJ BUDM FS/EA document adequately summarizes such previous studies as the *North Atlantic Coast Comprehensive Study: Resilient Adaptation to Increasing Risk* (NACCS), specifically as it relates to the guidelines and limitations authorized by the 26 October 2005, resolution of the Committee on Environment and Public Works of the United States Senate and the Disaster Relief Appropriations Act, 2013 (Public Law 113-2). However, several important issues need additional attention, discussion, and explanation.

The technical impact analyses in the environmental assessment were performed without coordination with many resource agencies. Although the main impacts have been identified, some issues still need to be resolved. A significant issue is that the NJ BUDM FS/EA is not yet environmentally compliant. It was published before developing an NED Plan, which would include the optimization of specific alternatives. The NED Plan optimization may change the identified impacts. Until the coordination with and response to the resource agencies has been completed and any changes that may occur during the NED Plan have been addressed, the report does not in its present form meet the procedural requirements of the National Environmental Policy Act. Also, Appendix D lacks an alternative analysis as required by Section 404(b) of the Clean Water Act.

The NJ BUDM FS/EA also does not clearly state the project's purpose and need. The report should explain why it only discusses the use of dredge material, why USACE chose to use the NACCS continuing

eligibility inspections screening tool, and how these issues affected the alternatives analysis. The discussion should cover the specific authorization limitations, how these limitations have affected the analysis of alternatives, and what the next steps are in the planning process. Clarification would allow the reader to better understand the overall focus of this report.

Civil/Design Engineering

The Panel recognizes the significant effort involved in developing this flood mitigation program. The Panel notes a few shortcomings in civil/design engineering that should be addressed, such as the criteria used for site selection, modeling, dune design, constructability, and design top elevations.

The Panel understands that the decision by Congress restricting the project to using only dredge material means that other possible options could not be considered, however, this is not clearly explained in the NJ BUDM FS/EA. The report should describe why other possibly more cost-effective alternatives were not considered and included in this project, such as purchasing, demolishing, or moving affected properties to higher ground or implementing warning and alarm systems. Because many other sites are probably also ready for improvement, some explanation should be provided to support the selection of only three sites for this project and to indicate what will be done for the sites that were not selected.

In an area with significant year-round navigation traffic, more information should be provided on how the construction schedule will be laid out to minimize potential adverse shipping impacts and to accommodate dredge material availability. Any shipping business impacts should be identified and mitigated.

More information should be provided on the proposed beach and dune elevation and designs. The report does not describe why the dredged material is suitable for beach and dune construction, factors such as appropriate composition for beach nourishment and constructing dunes, compatibility with receiving area material, potential for erosion of placed material, and the level of contamination of the dredged material.

The NJ BUDM FS/EA should provide more detailed explanations on how mathematical models, such as Beach-fx and riverine models, were used in the design of new dunes and groins and on the accuracy and adequacy of the results for making decisions at the feasibility stage. The report does not describe why a beach elevation of elevation level (EL) +5 was selected and why both a beach and a berm were selected for Villas Beach.

More details should be provided on the possible effects of wave radiation on nearby sites resulting from the new dunes and groins. New dunes will likely restrict stormwater flows, but the report does not discuss whether additional or enlarged outfalls will be needed in the dunes to release stormwater that accumulates behind the dunes. The NJ BUDM FS/EA does not describe how the proposed beach and dune structures would perform during severe storm events such as hurricanes and nor'easters or extreme events such as a tsunami, nor does it state how much protection the new dunes would provide.

Coastal Engineering

The intent of the actions proposed in the NJ BUDM FS/EA to beneficially use dredged material from federal navigation channels within the Delaware River and Bay and to recommend measures to manage and reduce risk from coastal storms. Considering that it is a feasibility study, the key issues have been

discussed and realistic assumptions and applicable approaches have been considered. The hydrology and hydraulics report is well written and the format is easy to follow.

That said, the NJ BUDM FS/EA should include some necessary information and clarifications on the assumptions and values utilized in the study. For example, Appendix C1 does not provide information on the sediment budget for the study areas, and it does not discuss the impact of proposed groins on the down-drift estuaries and environmentally sensitive areas. The land subsidence for the project areas and its consideration in sea-level change (SLC) needs more discussions. The infrastructure information and structure inventory for the project areas that were used in the Beach-fx model are not clearly discussed and defined. More discussion should be provided on why more detailed coastal analysis with local settings was not utilized. The main body of the NJ BUDM FS/EA does not discuss or evaluate the potential for secondary inundation resulting from flooding of the marshland or streams on the landward side of the various communities.

Geotechnical Engineering

The geotechnical analysis of the sediment available for use in beach nourishment is well described in the NJ BUDM FS/EA. The analysis makes it clear that the sediment in Reach E of the Delaware Bay is the appropriate grain size and material type for use in beach nourishment on the New Jersey shore. Past disposal of the same sediment type at the offshore Buoy 10 site implies that mining of sediment from the Buoy 10 site may also be a source for the initial beach nourishment activity.

The NJ BUDM FS/EA lacks analysis to assess the impact of primary consolidation settlement on the volume of nourishment required for the initial construction of the proposed beach profile. Significant primary consolidation settlement is likely where sand overlies much more compressible sediment deposited in the Delaware River estuary. High land subsidence rates from the secondary compression of these sediments, as noted in published references, confirms that primary consolidation settlement losses in the proposed beach nourishment profile could be significant to the feasibility of the project.

The analysis of means and methods to place the sediment by long-line pumping in a large open bay that is likely to experience high wave conditions is also a concern. The report should consider alternates to the placement method that would obviate the impacts of open sea conditions on the beach nourishment placement.

Hydrology and Hydraulic Engineering

The NJ BUDM FS/EA covers a broad range of issues that are expected to affect the project sites with respect to hydraulics, including coastal processes and SLC. There are three issues for which additional detail should be provided: 1) upland/creek/backbay flooding, 2) sediment transport impacts resulting from the proposed project, and 3) relative SLC. Additional discussion of upland, creek and/or backbay flooding is important to the overall success of the project because the proposed project has the potential to exacerbate flooding behind the proposed improvements. This is evident from a review of the effective Federal Emergency Management Agency Flood Insurance Rate Maps, which suggest insufficient flood capacity. Additional discussion is needed of the impact of the proposed project on sediment transport, considering both overall sediment behavior at the sites and how the proposed structures may impact sediment transport, particularly offsite. Finally, additional discussion should be provided about the details of the SLC analysis, including local geologic trends that partially affect local SLC.

4.2 Complete Panel Comments

This section contains the complete set of comments of the Panel. Each comment consists of four parts:

- **Comment:** A clear statement of the concern.
- **Basis for Comment:** A narrative describing the cause for the concern.
- **Significance:** A significance rating of the concern, as well as a statement supporting this significance rating.
- **Recommendation[s] for Resolution:** Recommended actions necessary to resolve the concern, including a description of any additional research that would appreciably influence the conclusions.

Comments were rated to indicate the general significance related to the project impact using the following definitions:

- **High** – There is a fundamental issue within study documents or data that will influence the technical or scientific basis for selection of, justification of, or ability to implement the recommended plan.
- **Medium High** – There is a fundamental issue within study documents or data that has a strong probability of influencing the technical or scientific basis for selection of, justification of, or ability to implement the recommended plan.
- **Medium** – There is a fundamental issue within study documents or data that has the low probability of influencing the technical or scientific basis for selection of, justification of, or ability to implement the recommended plan.
- **Medium Low** –There is missing, incomplete, or inconsistent technical or scientific information that affects clarity, understanding, or completeness of study documents, and there is uncertainty whether the missing information will affect selection of, justification of, or ability to implement the recommended plan.
- **Low** – There is a minor technical or scientific discrepancy or inconsistency that affects clarity, understanding, or completeness of study documents but does not influence the selection of, justification of, or ability to implement the recommended plan.

The Panel comments are provided in the following sections. The comments are grouped by their significance as determined during the IEPR.

4.2.1 Significance: High

Comment 1
It is not feasible in the open sea conditions of the lower Delaware Bay to pump dredged sediment removed from Reach E or Buoy 10 from the Hopper Dredge located near the edge of the navigation channel in a floating pipeline the long distances to Gandy's Beach (30,867 feet [ft.]), Fortescue Beach (41,679 ft.) or Villas Beach (45,877 ft.) (Appendix C3).
Basis for Comment
The report and the discussion during the project mid-point review meeting implies that, because of the shallow near-shore bathymetry at the project sites, the loaded hopper dredge will need to be located close to the navigation channel and the sediment pumped via pipeline to the project shore locations. This arrangement requires very long pipelines to reach the project sites in open water. For example, a pipeline almost 9 miles long would be required to reach the Villas Beach site as indicated in Appendix C3 and confirmed by measurement using Google Earth Maps. Wave height and chop in open sea conditions, such as the lower Delaware Bay, precludes using cutter suction dredges and floating pipelines when wave heights exceed 3 to 4 ft. As noted in the Feasibility Study, hydraulic cutterhead with floating pipeline is used for upper riverine reaches without the sea conditions of the lower reach in Delaware Bay. In addition to the floating pipeline, there would also have to be several booster pumps mounted on barges between the hopper dredge and the shore. Total horsepower (HP) on line would need to be 10,000 HP distributed between the hopper dredge and the boosters and capacity of the pumps to overcome 1,000 ft. of friction pipe loss, assuming a 20,000 gallons per minute (gpm) pump-off rate, a 24-inch diameter pipe, and a median grain size of 0.2 millimeters (mm) (calculation is provided in Appendix C of this IEPR report). The issue of open sea conditions could be overcome by sinking the pipeline and placing all of the boosters on jack-up barges. However, the risk if the pipeline becomes plugged is significant, and the cost to operate the pipeline system in a mode that obviates the impacts of sea conditions would be much higher than the current estimates.
Significance: High
The mode of moving the channel sediment to the beaches by pumping in a floating pipeline in open ocean conditions is not feasible. If the alternative is to sink the pipeline and place the booster pumps on jack-up barges, then the cost per cubic yard specified in Appendix C3 needs to be corrected.
Recommendation for Resolution
Recommendation #1: Conduct a more complete analysis of the risks and cost associated with a long-line pumping operation in open sea conditions and properly cost the option in recognition of the risk. **Recommendation #2:** Confirm that a contractor would be willing to accept the risk of operating a long pipeline with multiple floating booster pump barges in the open Delaware Bay sea conditions.

Comment 2

The effect of primary consolidation of underlying compressible sediment is not incorporated into the feasibility assessment. The additional volume of beach nourishment required to offset primary consolidation is not incorporated into the economic assessment. The potential impacts of settlement on adjacent structures (particularly at Gandy's Beach and Fortescue Beach) have not been assessed to determine feasibility.

Basis for Comment

All three beaches are on sand bars underlain by compressible sediment as alluded to in the text of the feasibility report. Aerial pictures of Gandy's Beach and Fortescue Beach (Google Earth Maps) show that both are storm-deposited sand bars in the middle of a large salt water marsh area. The sediment below these two beaches is likely organic silt and peat as referenced in the report and as indicated in Appendix C4, in which sediment in the channel below the sand at approximately -45 ft. is indicated to be organic silt.

Primary consolidation settlements from placing the proposed beach profiles could be several feet during the first few months after placement (see prediction below). The primary consolidation coefficient for organic silt is dependent on void ratio and may be even greater than shown on the calculation below. This settlement would be in addition to the long-term land subsidence and would have to be offset with additional volume placement to get the same desired beach effect.

The settlement under the new beach line load could lead to down-drag damage to adjacent structures near the placement. Review of the pictures in the report and the view from aerial photographs of each site indicates this is likely at Gandy's Beach and Fortescue Beach but not likely at Villas Beach where the structures are much further from the beach fill.

Estimate of Consolidation Settlement
Theoretical for Beneficial Use of Delaware River Sediment

Cc =	1	(estimate[1])	
Cs =	0.05		
Gamma =	55	lb/ft^3	effective unit weight
delta P =	1000	lb/ft^2	
Time	50	years	

depth (ft.)	Soil	P_0 (lb/ft^2)	E_0	S Primary (ft.)	S Secondary (ft.)
0					
5	SP	137.5			
10	OH	412.5	2.7	-0.72	-0.4247425
15	OH	687.5	2.5	-0.56	-0.4247425
20	OH	962.5	2.3	-0.47	-0.4247425
25	OH	1237.5	2.1	-0.41	-0.4247425
30	OH	1512.5	1.9	-0.38	-0.4247425
35	OH	1787.5	1.7	-0.36	-0.4247425
40	OH	2062.5	1.5	-0.34	-0.4247425

45	OH	2337.5	1.3	-0.34	-0.4247425
50	OH	2612.5	1.1	-0.34	-0.4247425
			Total	-3.92	-3.82268251

Definitions

Cc =	Primary Compression Index (Muskeg Engineering Handbook, approximately 0.0115 times water content)
Cs =	Secondary Compression Index (Mesri 1973, low end of likely values for organic silt)
Gamma =	Effective stress unit weight of sediment below water elevation
delta P =	Effective stress load added by proposed beach sand berm
SP =	Unified Soil Classification Symbol for poorly graded sand
OH =	Unified Soil Classification Symbol for high plasticity organic silt
P_0 =	Effective stress before adding new load at midpoint of each layer
E_0=	Initial void ratio
S Primary =	Primary compression settlement resulting from the addition of the new Po beach load
S Secondary =	Secondary compression settlement resulting over 50 years (not a function of load)

Footnote 1 - 1.0 used in calculation for all layers (likely higher in upper layers and lower in deeper layers)

Citations:

McFarlane, Ivan C., editor. *Muskeg Engineering Handbook*. Muskeg Subcommittee of the National Research Council of Canada, Associate Committee on Geotechnical Research, University of Toronto Press, 1969.

Mesri, G. *Coefficient of Secondary Compression*. American Society of Civil Engineers, *Journal of Soil Mechanics*, 99, SMI, pp. 123-137, 1973.

Significance: High

The volume of sediment required to construct the initial beach profile may be greater than the volumes available and the potential for damage to the structures may preclude installation of the profile proposed in the report.

Recommendation for Resolution

Recommendation #1: Obtain the information required to assess the impact of primary consolidation settlement under the beach areas, and incorporate the information into the feasibility analysis at all three beaches.

Recommendation #2: If damage to structures is likely at Gandy's and Fortescue Beach, move the fill further from the structures to avoid settlement damage.

Comment 3
Numerous pending coordination activities are outstanding as outlined in Table 17 - Summary of Environmental Compliance, page 63.
Basis for Comment
Completing all of the coordination is required before the project can proceed.
Significance: High
Coordination and compliance are required before a Finding of No Significant Impact (FONSI) determination can be made.
Recommendation for Resolution
Recommendation #1: Finalize all environmental coordination prior to signature of FONSI.

Comment 4
The cost basis for the Tentatively Selected Plan (TSP) is not clear and cannot easily be determined from the report.
Basis for Comment
Main Report, Page 53, Section 3.5 Plan Selection. Second paragraph, last sentence states, "Beyond this 10 year threshold, the Federal standard will likely involve the placement of dredged material at Artificial Island CDF, located approximately 40 miles upstream from the dredged TSP source location." However, it would seem from the discussion in the last paragraph, page 56, Appendix A, that the project costs for the TSP were based on placement at Buoy 10 and/or Artificial Island.
Significance: High
The project cost is critical to determining the feasibility of the project. The basis for the cost must be clearly identified to allow the reviewer/reader to reproduce the cost and determine the feasibility of the project.
Recommendation for Resolution
Recommendation #1: Revise the report to better clarify the basis of the cost for the TSP.

Comment 5
The report does not describe why upland/creek/backbay flooding was excluded from the analysis, why this type of flooding is not important to the project, or if outfalls will be needed in the dunes to release stormwater that accumulates behind the dunes.

Basis for Comment
The detailed discussion of backbay flooding and its importance for the project sites is missing from the report. The report does not discuss or evaluate the potential for secondary inundation resulting from flooding of the marshland or streams on the landward side of the various communities. A brief review of the Federal Emergency Management Agency Flood Insurance Rate Maps panels for the project areas (34011C0312E, 34011C0406E, and 34009C0216) indicate that the properties to be protected by the project are in Zone AE, with a Base Flood Elevation (BFE) ranging from 8-11 ft.. The ground elevation is generally 1-4 ft. below the BFE. For events up to and including the 0.01% annual probability event, the presence of upland flooding (that is, flooding not originating from the Delaware River) may be exacerbated by the presence of the proposed berms as the project can effectively block drainage from the upland areas to the Delaware River. The current draft of the study suggests that rainfall runoff would be stored in the marsh and pond areas with limited increases in outflow or ponding into the bay areas. However, the effective FIRM panels suggest that this is not the case.
Significance: High
The project has the potential to cause or exacerbate existing upland/marsh flooding and can influence the requirements for the project. One of the goals of this project is to reduce the risk of flooding for the shore communities and it is crucial to add a discussion of the significance of backbay flooding in the report.
Recommendation for Resolution
Recommendation #1: Describe the methodology that was used to determine that upland flooding will not be exacerbated by the presence of the project. If no analysis was done to support the assumption of sufficient upland (or wetland) flood capacity to mitigate the presence of the project, the report needs to provide technical justification to support the assumption. **Recommendation #2:** Update the report and relevant appendix to include the discussion in Recommendation #1. At a minimum, flooding conditions in the marsh and ponding areas in the existing condition should be documented during severe storms (like Hurricane Sandy), including depth of flooding and changes in outflows into the bay area. Additionally, add to the report a discussion about backbay flooding and the effect the project will have on flooding at the project sites.

4.2.2 Significance: Medium High

Comment 6
No National Economic Development (NED) Plan was identified in this report. Various levee heights are shown for the three areas where projects are recommended, but none bracket the NED plan.
Basis for Comment
Engineer Regulation (ER) 1105-2-100 requires that an NED Plan be identified in each feasibility report. If the TSP is different from the NED, then detailed information is required. If NED costs less than TSP, locals will probably have to pay the difference.
Significance: Medium High
If the NED Plan is different from the TSP, the cost sharing could be affected.

Recommendation for Resolution
Recommendation #1: Include a NED Plan in the report or provide an explanation of why a NED Plan could not be formulated.

Comment 7
The cost analysis for Initial Construction in Appendix C3 is too high for Alternate E. The cost analysis for Initial Construction for Alternate A and B is likely too low for the open water pumping conditions priced.
Basis for Comment
The review has assumed that the \$8/yard (yd)^3 (\$7,286,550/900,000 yd^3) for present maintenance dredging with disposal at Buoy 10 is the only certain value in the cost analysis. The following is the Panel's analysis of several cost considerations and its effect on several options. Option E would add 60 miles of additional sailing time at 13 knots (4 hours) to a hopper dredge cycle and would require 1.5 hours to pump off at 20,000 gpm, adding a total of approximately 6 hours to a dredge cycle compared with approximately 3 hours for sailing and disposal at Buoy 10. Direct ratio of 6 hours/3 hours and assuming ½ of \$8/yd^3 for transport results in a cost to transport to Artificial Island Confined Disposal Facility (CDF) of \$12/yd^3 - \$16/yd^3. The cost for Option E in Appendix C3 is double the maximum reasonable value at \$32/yd$^{3.}$ Option A and B must include the cost to operate a long line hydraulic pipeline of 6- to 8-mile length requiring 6 to 8 barges with booster pumps. Assuming in response to the issue of feasibility, the pipeline is sunk and the barges are jack-up barges, the daily cost to operate is likely 10 times the daily cost to run just the hopper barge with open ocean disposal. The daily cost reflects the cost of equipment, fuel, and personnel to operate the multiple boosters and the shoreline spreading and beach training operations. It is likely that the cost should be at least \$80/yd^3 and possibly more considering the cost of risk for plugging the submerged pipeline is considered in the contractors' cost.
Significance: Medium High
The economics of the replenishing the beach nourishment is based on using Buoy 10 for the first 10 years and hauling to Artificial Island for the remaining 40 years as the no-beach-nourishment action alternate. Reducing the cost to move the sediment to Artificial Island CDF to 50% of the current cost is likely to change the economic conclusions. No assessment of that impact has been done by the Panel, and thus the medium-high assignment on the assumption that the change could be critical.
Recommendation for Resolution
Recommendation #1: Provide an actual analysis of the scope of work and cycle times for the estimates provided to support the validity of the unit cost for the disposal at the Artificial Island CDF and for the beach nourishment activity using long-line pumping.

4.2.3 Significance: Medium

Comment 8
The report does not describe how sediment transport was determined for the study, nor is a sediment budget for the project sites provided.
Basis for Comment
Sediment transport in the Delaware River has the potential to impact the longevity of the present project. For example, highly erosional flows in the river or its tributaries can lead to erosion of the project sites in some high-water circumstances (e.g., discharges or storms following extensive dredging activities). At present the basis for determining the erosion rate at the project sites is based on historical changes of the shoreline. However, no sediment study has been done to determine the sediment budget for the project sites, and no justification/explanation is given for not providing a sediment budget for the sites.
Significance: Medium
Standard USACE procedure is to develop a baseline of sediment transport for the project and to examine deviations from that baseline for each alternative considered. This is needed to identify any impacts that the project will have on sediment transport-related project elements. Moreover, since the project is about using dredge material for beach nourishment and sediment transport has a significant effect on the frequency of nourishment, it is crucial to study the sediment movement and develop a budget.
Recommendation for Resolution
Recommendation #1: Develop a baseline for sediment transport at the sites and use the information to determine a sediment budget. **Recommendation #2:** If no baseline is developed, justify the process used to consider sediment transport in the study and explain how the information is adequate for making decisions at this stage in the project development. Also, justify in the report why the historical shoreline changes study is sufficient for the project areas in lieu of the method used in the study.

Comment 9
The effect of the terminal groins on the down-drift side of the groins is not considered in the report, and the proposed groins will effect sediment movement and cause off-site erosion.
Basis for Comment
The purpose of groin placement is to interrupt sediment movement and capture material to increase shore width. The interruption of sediment movement, however, will lead to reduced sediment on the down-current or downstream banks and ultimately lead to erosion. This erosion runs counter to the purpose of the project. The report does not discuss how erosion created by placement of groins will be mitigated or mediated, if periodic nourishment on-site will be sufficient, or what are the types and scale of potential negative effects on the estuaries and the conservation areas.

Significance: Medium
Downstream or down-current erosion may shift erosion location or cause erosion that was not present prior to the project. In addition, since the groin extension or construction of new groin can permanently cause erosion to the down drift estuary areas, it is crucial to study it.
Recommendation for Resolution
Recommendation #1: Describe how the long-shore analysis for groin placement was completed, and describe the off-site impacts resulting from groin placement, particularly in estuarine and conservation areas. Also, describe how mitigation measures for long-shore sediment transport interruption will be implemented and maintained.

Comment 10
The report does not describe how wave radiation effects resulting from the new dunes and groins on nearby sites were considered.
Basis for Comment
Construction of new dunes and groins normally is expected to cause wave radiation to other parts of nearby sites. This topic needs to be addressed, including details of the relative sizes of the wave radiations and how impacts are to be minimized, if and when needed
Significance: Medium
This project could affect both sides of the dunes and requires a full understanding of the issue.
Recommendation(s) for Resolution
Recommendation #1: Add information on wave radiation effects into the report.

Comment 11
SLC should be clarified as “relative SLC”, which includes both real SLC and land subsidence. The report does not state how the baseline for SLC calculations was established or describe how geotechnical changes, including land subsidence, were considered in the calculations. Also, only actual SLC has a “climate change component”.
Basis for Comment
SLC calculations begin using a baseline Water Surface Elevation (WSE). ER 1100-2-8162 defines the baseline for analysis as local Mean Sea Level (MSL) relative to the NAVD 88 vertical datum (Section 5.2.b). The study does not explain how the baseline WSE was selected or determined, nor describe what the basis was for the selection of the starting WSE. ETL 1100-2-1 requires the analysis of local MSL factors, including vertical land motion (Section 2.3.b). Available reference publications on the South New Jersey coast (e.g., *Sea-Level Rise in New Jersey fact sheet*, Miller et al. of Rutgers University) indicate that land subsidence is the majority component in “Relative SLC” in the project area. Land subsidence is shown to be increasing at a rate greater than the

water component of SLC. (Atlantic City shows 3mm/yr land subsidence and 1.5mm/yr SLC). Land subsidence from the secondary consolidation of organic silt and peat under the sand bars at Gandy's Beach and Fortescue Beach are likely significant to the appearance of sea level rise. The effect at Villas Beach is likely to be less significant due to its location on the back side of the ocean sand bar. The report does not describe how geotechnical factors (here, locally) were considered in the calculation of SLC and the basis for that analysis, nor does the report state if these analyses follow the Engineering Regulations and Engineer Technical Letters or used other documents in the analyses.

The fact that USACE is using EC 1100-2-8162 as the basis for the relative SLC predictions may be adequate to include the effects of both land subsidence and actual SLC.

Land subsidence is not due to climate change as implied in the text of the report. The report should not mischaracterize the cause of the relative SLC as resulting only from climate change.

Significance: Medium

The future planning of the project is based on the relative SLC. It is crucial to this value to consider local land subsidence and for this to be explained well in the report. Additionally, documenting SLC criteria is important for understanding the impacts of change and ensuring that SLC analysis does not under- or over-predict SLC.

Recommendation for Resolution

Recommendation #1: Amend the text to define SLC as relative SLC and to indicate that the significant part of the change is from land subsidence, not climate change.

Recommendation #2: Provide additional documentation about how the baseline WSE was determined and how local geotechnical factors were considered in the study.

Recommendation #3: Add a discussion to the report describing how the land subsidence component of relative SLC was estimated for the project sites. Discuss how local geotechnical factors were considered in the study. If local subsidence factors were not used, justify how non-local data are adequate for purposes of this study.

Comment 12

The report does not explain why the Continuing Eligibility Inspections (CEI) screen tool, which is heavily weighted 80% infrastructure and 20% environmental, was used in the analysis.

Basis for Comment

This is a primary factor in the determination of costs and strongly slants the location of dredge material placement to existing development. If there were a better determination of the environmental and economic costs and location and the amount of marsh loss along the New Jersey shore, the placement location may be located where there was greatest loss of shoreline and not adjacent to existing development.

Significance: Medium

The environmental and economic costs and location and amount of marsh loss along the New Jersey shore are probably beyond the scope of this project.

Recommendation for Resolution
Recommendation #1: Explain why USACE chose to use the CEI screen tool and not a tool that has a higher environmental weighting.

Comment 13
The ratio of the wave height to the depth is limited to the so called breaker index $(H/d)_b$. Some of the values seem incorrect in Table 7: NACCS [*North Atlantic Coast Comprehensive Study*] Water Level Annual Exceedance Probability and Table 8: NACCS Wave Height Annual Exceedance Probability. In these tables, the ratio of wave height to the depth exceeds the Breaking Wave Height to the Depth Ratio and is not in the range of the routine wave breaking ratio of 0.7 to 0.8.
Basis for Comment
The ratio of limiting wave height to water depth or the Breaking Wave Height to the Depth Ratio is about 0.7 to 0.8 for engineering practices in shallow water and for coastal engineering design and the values from the tables provide a higher ratio.
Significance: Medium
Since the values are used for the wave height where the save point is located and storm surge or water depth is available, the breaking wave ratio needs to be confirmed and, if applied outside normally accepted ranges of Breaking Wave Height to the Depth Ratio, an explanation added to the report.
Recommendation for Resolution
Recommendation #1: Correct the values as needed and add explanation of the value to the report.

Comment 14
The report does not provide adequate details about the Beach-fx model, such as model calibration and accuracy. Also, the report does not clearly describe how the infrastructure information and structure inventory for the project areas to be used in the Beach-fx model were determined and defined.
Basis for Comment
Limited information is provided on the model set up and for which specific project sites the Beach-fx model has been utilized. Blurry graphics were provided that invite other questions and increase modeling uncertainties. The explanation of other agencies' involvement in setting up the model and USACE involvement is not clear. Also, model limitations, if any, are not discussed. Infrastructure information and a structure inventory are needed as part of the input data to utilize the Beach-fx model to estimate the economic benefits of the beach nourishment projects. To calculate a realistic benefit/cost ratio, the infrastructure inventory of the project area should be included in the analysis.
Significance: Medium
The lack of adequate information makes it hard to determine if more information would influence the project. The cost ratio for this project depends on what can be saved from the no-project alternative,

and it is significant to describe the consideration of infrastructures such as roads, utilities, and sea walls in the report.
Recommendation for Resolution
Recommendation #1: Discuss the mentioned concerns to clarify and include the critical role of this model in the project. Add a discussion to the report about how the structure inventory was determined and defined for use in the Beach-fx model analysis.

Comment 15
The report does not describe why a beach elevation of EL +5 was selected and why both a beach and berm were used for Villas Beach.
Basis for Comment
A new beach structure can be designed using multiple criteria. However, limited information is provided on what led, for example, to a top elevation of +5' MSL as graphically shown in the figures. Also, both a berm and a dune were designed for the Villas Beach site. An adequate explanation is not provided as to why the adopted designs were selected.
Significance: Medium
This issue prevents a clear understanding of the design process as a whole.
Recommendation(s) for Resolution
Recommendation #1: Provide better explanations, clarifications, and justification for the designs selected.

Comment 16
The report does not provide the construction schedule for the projects or discuss the issues and factors that will determine the schedule.
Basis for Comment
The project could possibly be done in a year for all sites, assuming there will there be enough dredged material for the sites. A major impact would be navigation traffic during nighttime, daytime, or any season that probably requires close construction scheduling with shipping companies. Table 8 in the main report contains national economic data, but economic impacts to the shipping companies—the main parties likely to be affected by the project construction—appears to be excluded. The need to temporarily relocate the residents (at least some of them) during certain phases of the construction could come up to ensure maximum safety.
Significance: Medium
This issue involves the parties expected to be the most affected by the project.

Recommendation(s) for Resolution
Recommendations #1: Describe the factors that will determine the construction schedule and provide an estimate of what the schedule will be. Identify impacts on commercial shipping.

4.2.4 Significance: Medium Low

Comment 17
Detailed and local coastal modeling for each site or for the bay might be needed. The report does not provide adequate information about the riverine model used to analyze hydraulics and hydrology issues associated with the project, such as model set up, calibration, and topographic and bathymetric data used in the model.
Basis for Comment
The report is relying on the results from the NACCS, which was finalized in January 2015 and was updated and incorporated model refinements as new data became available. The NACCS model is a regional model and covers a large area. It would be beneficial to the project to consider localized modeling of the bay as wind roses are prepared and wave analysis based on their fetch length can be done. Modeling details provided so far in the main report do not seem to attach importance to the riverine model used.
Significance: Medium Low
As the purpose of this study is the feasibility of using the dredge material, the NACCS model would be a good starting point, but a more detailed study can be helpful for the final designs. Modeling details provided so far in the main report do not seem to attach importance to the riverine model used.
Recommendation for Resolution
Recommendation #1: Investigate the value of performing more detailed modeling for the study areas. Perform additional modeling if the results will improve the design. Describe in the report how the riverine model was used in the analysis. **Recommendation #2:** If more detailed or local modeling is not performed, explain in the report why the available data are sufficient to support the decision being made and additional modeling is not needed.

Comment 18
The report does not clearly explain how all the initial candidate sites were analyzed and the three final sites selected.
Basis for Comment
There are several sites in the Delaware Bay area that face the same type of erosion problems and could benefit from repairs using dredged material. Why the number of sites was limited to three is not clearly documented in the summary report. This could be because of the number of threatened structures,

urgency of the situation, size of the potential damages, number of local population affected, specific recommendations from interest group(s), etc.
Significance: Medium Low
In addition to the cost factor, public support and a clear understanding of the need for the project is critical to its implementation. There is incomplete technical information that affects clarity, understanding, or completeness of study documents, and there is uncertainty whether the missing information will affect the selection of, justification of, or ability to implement the recommended plan.
Recommendation(s) for Resolution
Recommendation #1: Provide more detailed explanation of how the three sites were selected.

Comment 19
Appendix D – *404(b) Analysis* does not have an alternative analysis.
Basis for Comment
Under the 404(b) guidelines the following is required: *(c) Examine practicable alternatives to the proposed discharge, that is, not discharging into the waters of the U.S. or discharging into an alternative aquatic site with potentially less damaging consequences (§230.10(a)).*
Significance: Medium Low
There are two alternatives: add sand to the three determined beach locations or continue using the existing disposal areas. The other beach locations are shown not to be cost-effective.
Recommendation for Resolution
Recommendation #1: Add practicable alternative discussion or explain why there are not alternatives.

Comment 20
The report does not explain clearly why the TSP only includes beach nourishment and constructing berms and groins. Normally, other options like moving housing and structures to safer, higher grounds are also considered, an alternative based on an inventory of unsafe structures affected by flooding.
Basis for Comment
The proposed solution seems to be focused on repair and/or construction of new berms and/or groins. Normally, other potential solutions that could reduce costs would be to relocate unsafe structures to higher grounds; an alternative based on an inventory of unsafe structures could be affected. This is needed to provide a full picture of the issues and acceptable solutions.
Significance: Medium Low
The ability to ensure a full understanding of the challenges at hand is currently missing or is not addressed with sufficient details in the report.

Recommendation(s) for Resolution
Recommendation #1: Include more detailed information in the report on why the TSP considers only beach nourishment and constructing berms and groins.

Comment 21
The report does not explain why warning and alarm systems and other non-structural issues were not analyzed.
Basis for Comment
Warning and alarm systems are routine procedures in place to reduce coastal and riverine flooding threats to life and public safety. This option was cursorily mentioned in the summary report, but the whole subject was left untouched because non-structural solutions were not part of the project authorized by Congress.
Significance: Medium Low
Need to ensure full public understanding of the situation.
Recommendation(s) for Resolution
Recommendation #1: Explain in the report why warning and alarm systems were not considered.

Comment 22
The report does not discuss how the TSP will protect against historical storms such as Hurricane Sandy, nor'easter storms, and a tsunami.
Basis for Comment
More recent hurricanes like Hurricane Sandy were mentioned in the report. This is helpful for the public who can still remember some of the effects of that historical storm. For references and statistical comparison purposes, how strong were Sandy's winds and rainfall in terms of historical occurrence frequencies?
Significance: Medium Low
Need to ensure full public understanding of what protection the TSP will provide, using recent historical events.
Recommendation(s) for Resolution
Recommendation #1: Describe in the report the purpose of the TSP and how the purpose is related to protecting against historical storms such as hurricanes, nor'easter storms and a tsunami.

Comment 23
The report does not discuss the contamination status of the dredged material to be used in the project.
Basis for Comment
This question is closely related to the question of suitability of silt material for embankment/levee construction. If there is a risk of contamination, solutions to avoid and/or minimize the problem should be addressed in full.
Significance: Medium Low
Sediment contamination is an important issue for the project and needs to be evaluated.
Recommendation(s) for Resolution
Recommendation #1: Discuss the sediment contamination status in the report.

4.2.5 Significance: Low

Comment 24
The Purpose and Scope (Purpose and Need) does not clearly delineate the rationale for this report, justify why this report was prepared, and explain why it only focused on coastal storm risk management (CSRM) benefits and not protection for erosion of the entire coast line, including the marshes.
Basis for Comment
The Purpose and Scope should establish the basic purpose and need for the specific project and the system wide consequences of the proposed project and the no-build alternative. If an alternative does not satisfy the purpose and need for the project, as a rule, it should not be included in the analysis as an apparently reasonable alternative. However, it should be clearly explained why an alternative is not reasonable (or prudent or practicable) and why it was not be selected.
Significance: Low
The Purpose and Scope is inadequate and very poorly presented. It does not describe or provide the reader with any explanation of the narrow focus of the project, which is crucial to understanding why USACE has eliminated other alternatives and has not studied some issues.
Recommendation for Resolution
Recommendation #1: Explain why the conclusions of the CSRM report were used and what the next phase of determining the NED plan. **Recommendation #2:** Add discussion on mandates listed in the February 13, 2015, Peter R. Blum P.E. memorandum. **Recommendation #3:** Explain why USACE chose to use the CEI screen tool. **Recommendation #4:** Include or refer to the discussions in Sections 2.5, 2.6, and 3 concerning the selection process for determining the TSP. **Recommendation #5:** Add more information on the cost analysis.

Comment 25
The current Federal Discount Rate is not used in the study.
Basis for Comment
Effective 1 October 2017, the Federal Discount Rate is 2.75 percent instead of 2.875 percent. The District should calculate the benefits and costs at the current Federal Discount Rate.
Significance: Low
The use of the current Federal Discount Rate will probably have no effect on the TSP.
Recommendation for Resolution
Recommendation #1: The District should include an addendum in the report presenting costs and benefits at 2.75 percent for all alternatives on page 47 of Appendix A.

Comment 26
The definition of "coarse grained material" should be clarified to be 90% or more by dry weight of sand.
Basis for Comment
When first defined in the text, coarse grained is defined as more than 50% by dry weight sand.
Significance: Low
The report demonstrates that the sediment in Reach E is suitable for beach nourishment and has a grain size that is 90% by weight or greater sand. Since this is the acceptable criterion, the text only needs to be edited to clarify that this is the only criterion of acceptance.
Recommendation for Resolution
Recommendation #1: Make certain the definition of "coarse grained material" matches the requirements for beach nourishment.

Comment 27
Units are missing from Table 4: Tidal Datum Relationship, Appendix C1.
Basis for Comment
The datums are referenced to 1983-2001 and NAVD 88, but units such as feet should be mentioned in the table.
Significance: Low
It is not a significant error and can happen in any report, but this needs to be fixed even though readers familiar with different datums can figure out the units.
Recommendation for Resolution
Recommendation #1: Add units to the table.

Appendix A Qualifications of the Independent External Peer Review Panel Members

The detailed qualifications and experience of each IEPR Panel Member (in alphabetical order) is provided below.

A.1 Mr. Timothy Harrington, PE

Role: Geotechnical Engineering

Mr. Harrington is a private consultant providing geotechnical engineering services to contractors, engineers, and owners in the area of sediment removal, dewatering, and reuse. He is a registered engineer in the states of Indiana, Michigan, Illinois, Wisconsin, and California. He has previously held engineering registration in both New Jersey and Delaware, the states adjoining the Delaware Bay. Since obtaining his MS degree in Geotechnical Engineering from Michigan State University, he has had 42 years of experience in both geotechnical engineering and marine construction.

He was employed by D'Appolonia Consulting Engineers of Pittsburgh, Pennsylvania, for 6 years, by Canonie Environmental, a design/construction firm, for 12 years, by Rust Remedial Construction for 2 years, and as a private consultant for the last 22 years. He has provided geotechnical engineering designs and implemented many USACE and private client geo-construction efforts throughout his long career. He is familiar with USACE construction practices including the deepening of harbors, nourishment of beaches, and maintenance of river channels and the removal of contaminated sediment. Projects with direct USACE involvement have included the following: deepening of Port Everglades at Ft. Lauderdale, Florida, in the mid 1980's; nourishment of the beach at St. Petersburg, Florida, using maintenance dredging in the late 1990's; nourishment of the beach at St. Augustine, Florida, borrowing from a Confined Disposal Facility in the early 2000's; nourishment of the Lake Michigan shore near Chicago, Illinois, from maintenance dredging in the early 1990's; removal, dewatering, and treatment of the highly contaminated sediment from Waukegan Harbor, Illinois, in the early 1990's; removal of lead shot from sediment with restoration to the beach at Lordship Point, Connecticut, in the early 2000's; and removal, dewatering, and treatment of contaminated sediment from New Bedford Harbor, Massachusetts, ongoing since 2005.

He has participated in a previous USACE IEPR review for the Cat Island Facility in Green Bay Harbor, which used maintenance dredging to reconstruct wave attenuating islands that formerly existed in Green Bay prior to the settling of underlying harbor sediment. He also participated in a USACE Value Engineering Study for removal of the remaining sediment in Waukegan Harbor in 2006.

Mr. Harrington has provided expert services in testifying on more than a dozen projects that involved knowledge of sediment properties, handling characteristics, and means and methods of removal. The projects have included such high profile Superfund projects as Twelve Mile Creek in South Carolina and the Hylebos Waterway in Tacoma, Washington. Numerous projects have included the issue of differing site conditions inherent in marine construction activities, including the impact of consolidation settlement in the construction of marine earthworks.

As the responsible general manager for Canonie Environmental, Mr. Harrington was responsible for $30 to $40 million of construction work per annum that included major marine based projects at

Waukegan Harbor, Illinois; Hudson River, New York; and Housatonic River, Massachusetts. During Mr. Harrington's tenure as general manager at Rust Remedial, he was responsible for the direction of a total backlog of work exceeding $100 million. His construction experience provides his background in the means and methods of cost-effectively removing and handling sediment. The experience is distinct to both the management of contaminated and non-contaminated sediment as applied to this IEPR.

A.2 Dr. David Jaffe

Role: Hydrology & Hydraulic Engineering

Dr. Jaffe has worked for more than 15 years at the intersection of water resource development, water infrastructure design, and water policy in coastal and riverine environments. This work has included analysis, design, and related regulatory elements. Dr. Jaffe has focused his technical expertise on the translation of engineering science into actionable environmental benefits, including protection, restoration, and remediation. His areas of technical focus are hydrology, hydraulics, and sediment transport. Dr. Jaffe utilizes a broad scope of numerical and analytical methods, including a wide range of numerical models, and is an expert in applying existing, off-the-shelf tools to provide in-depth and forward-looking analysis and insight to solve complex hydraulic problems.

Dr. Jaffe has maintained his academic and research associations and currently serves as a lecturer in civil engineering design. He earned his PhD in Civil & Environmental Engineering. He is a registered Civil Engineer and a member of the American Society of Civil Engineers. Dr. Jaffe is also a diplomat for the American Academy of Water Resource Engineers.

Dr. Jaffe's current area of research focuses on using sediment transport, through modeling and measurement, as a proxy for several facets of environmental analysis and design. His background in physical marine science, riverine hydraulics, and numerical modeling provides a broad foundation for developing solutions in a diverse pallet of aquatic habitats, including those at the intersections of littoral and riverine systems. Dr. Jaffe also manages projects and programs that deal with environmental policy and systematic risk. These project and programs include large or regional government projects and small, locally driven initiatives covering a broad spectrum of agencies and interests. Dr. Jaffe has served as a project manager for federal and state projects, in particular those of FEMA, NMFS, USACE, USEPA and USBR.

Dr. Jaffe has extensive experience in using numerical models for coastal and riverine analysis, both commercial and proprietary. Dr. Jaffe's modeling experience includes significant use of modeling packages from federal agencies, HEC in particular.

In a recent project, Dr. Jaffe participated in the analysis to evaluate the impacts from changes to local scour resulting from proposed bridge improvements. In the project, a HEC River Analysis System (HEC-RAS) model was employed for analysis of stream hydraulics. Sediment and hydrologic data were taken from previous efforts, and additional analysis was required to determine downstream boundary conditions for tidally controlled water surface elevation. The study followed HEC-18 criteria in that general, long-term, and local bed adjustment were considered. Bridge hydraulics and related scour were modeled in HEC-RAS. The study found the pier and abutment scour dominated bed impacts. Long-term bed adjustment was found not to be significant factor in impacts since the stream is in an aggrading condition, with regular dredging to control streambed shape and elevation. Dr. Jaffe led the bridge hydraulics and bridge scour effort as part of the bridge replacement effort.

Dr. Jaffe led the technical review of the numerical modeling and alluvial fan analysis of the project. Douglas County, Nevada, retained an outside consultant to perform a restudy of the Airport Wash, Johnson Lane Wash, Buckbrush Wash, and Sunrise Pass Wash watersheds and Phase II of the Buckeye/Martin Slough watershed located in western Douglas County, Nevada. The purpose of the restudy was to submit a FEMA Physical Map Revision and substantially revise portions of the effective 2010 Flood Insurance Study (FIS) and corresponding Digital Flood Insurance Rate Maps (FIRMs). The restudy sought to establish updated FIS peak flow rates and hydrographs at specific locations and provide corresponding floodplain mapping revisions to portions of the 2010 effective FIRMs for Douglas County. The modeling review consisted of multiple FLO-2D models and the methods used by the outside consultants for hydraulically connecting the different models through differing boundary conditions. Other areas of specialty review included the use or absence of culverts, model stability (Courant–Friedrichs–Lewy or CFL condition), and boundary condition applications. The supporting Letter of Map Revision documentation was also reviewed.

Dr. Jaffe developed protocols for and led the pilot study that examined the hydraulic climate change impacts to infrastructure along the south bank of Guadalupe River in San Jose based on a 50-year (2012-2062) time horizon. The study compared the existing and future conditions, levee deficiency, and resulting existing and future floodplain conditions using one- and two-dimensional hydraulic modeling, as well as GIS-based tool sets. Sea level rise was a primary consideration. The impacts to existing bridge soffits in the existing and future conditions were also examined. A preliminary economic impacts analysis was conducted using parcel assessment maps and GIS tools based on 2012 dollars. The conclusion of the study outlined future analytic pathways for analysis of climate change impacts to infrastructure and habitat in riverine systems, including sediment transport and bulking, and watershed burn and sediment yield.

He also participated on a project evaluating the HEC-6T numerical modeling, based on recently update FEMA HEC-RAS numerical models. He was employed to determine the magnitude and extent of impacts that large bed load particles would have on improvements to the Freeman Diversion in Santa Clara River. Specifically, improvements to the diversion are intended to improve sensitive and endangered fish species migration within the river. Several design, operation, and long-term maintenance elements of these improvements are dependent on the size range and relative frequency of the largest particles transported as bed load during 100-year and other large flow events. The study, led by Dr. Jaffe, estimated the largest size of particulate impacting the structure during the FEMA 100-year discharge and the relative frequency of these large particles in the bed load.

He led the modeling and design support team to develop improvements to the existing USACE levee with the City of San Jacinto. He led sediment data collection efforts and hydrology determination, including design storm and long-term hydrographs, numerical modeling, gas pipeline protection measures, levee top- and toe-elevation determination, bridge design criteria, and downstream habitat impacts analysis. The project included historical and gravel mining operations analysis. He coordinated with the local Indian tribe to address local tribal concerns. The primary design concern was to restore river habitat and functions while minimizing impacts to downstream special habitat areas.

Dr. Jaffe led two-dimensional numerical modeling of the Oxnard floodplain, including drainage channels, that was conducted to determine the extent of flooding below Highway 101 and upstream of the Pacific Ocean for the 100-year floodplain. The study examined the three sub-watersheds developed by the Ventura County Watershed Protection District including Hueneme Drain, “J” Street Drain, and Rice/Industrial Drain, separately. The goals of the study were 1) to estimate the locations and extents of flooding

on the Oxnard floodplain, including acreage of inundation and 2) to determine the discharges at the floodplain outflow. A FLO-2D numerical model was developed for each of the three sub-watersheds, the boundaries of which closely follow those used in Ventura County's VCRat model. The model grid was assembled using FLO-2D's Grid Developer System (GDS) software and established by importing Digital Terrain Model data provided by Ventura County into the GDS. Model parameters were then imported into the GDS. Following collection and importation, data was area averaged on a grid-cell-by-grid-cell basis. Hydrology for all simulations was the county's design 100-year, 24-hour rainfall, Zone B, and was provided by the county's hydrology branch. Modeling suggested that existing topographic conditions determined where flooding occurred adjacent to existing channels. Improvements were recommended based on the location of the topographic controls.

A.3 Mr. Timothy Love

Role: Biological Resources & Environmental Law Compliance

Mr. Love is a certified professional wetland scientist with extensive experience in wetland identification and delineation. He has comprehensive knowledge of current USACE regulations and permitting issues concerning jurisdictional waters of the United States and an extensive background in data collection, field investigation, document preparation, and agency interface related to wetland delineations, threatened and endangered species evaluations, and coordination of federal permits required under Section 404 of the Clean Water Act, Section 10 of the Rivers and Harbors Appropriation Act, and including mitigation.

Mr. Love has recently retired after nearly 40 years from a major engineering firm where he was responsible for the preparation of EAs and EIS documents as required by NEPA. Typical NEPA projects include major highways, shore, and naval facilities.

As an environmental scientist, Mr. Love prepared the biological section to the EISs for base realignment, including information about threatened and endangered species and marine mammals, and helped in the design of all required mitigation under all federal and state permits, such as the Department of Army permits under Section 404 for the Base Realignment Mine Warfare Center of Excellence, U.S. Navy, Naval Station Ingleside, and Naval Air Station Corpus Christi, Texas. He also prepared the biological section of the EISs for Base Realignment Naval Air Warfare Center Aircraft Division, U.S. Navy, Patuxent River, Maryland, which included a section on the biological resources of Chesapeake Bay that was used to support applications to the Department of the Army and State of Maryland permits under Section 404 and state-required permits.

Mr. Love has also prepared the sections on Wildlife and Habitat; Threatened and Endangered Species; Terrestrial; Wetlands; and Oyster Mitigation review for the following projects: 1) the Houston Ship Channel Expansion Channel Improvement Project, Harris, Chambers, and Galveston counties, Texas; 2) the Draft Integrated Feasibility Report – EIS for the USACE-Galveston District and for the Port of Houston Authority Bayport Ship Channel Improvement; and 3) the Barbours Cut Channel Improvement Projects, Section 204(f) Assumption of Maintenance Assessment Report for Harris and Chambers counties, Texas.

Mr. Love is an Emeritus Director of the Galveston Bay Foundation. He is the Immediate Past Chair of Executive Committee, Co-Chair of the Permits Committee, and a member of the Land Committee. His

previous work included conducting water quality sampling, water quality enforcement, and reviewing and revising water quality stream standards in Arizona.

A.4 Dr. Nader Mahmoudpour

Role: Coastal Engineering

Dr. Mahmoudpour has a PhD and PE registration as a civil engineer. He earned his Bachelor of Arts in Civil Engineering, MA in Hydraulic Structures, and PhD in Water Resources. He has over 24 years of experience as a civil and water resources engineer conducting hydrologic and hydraulics analysis for riverine systems, and for two-dimensional hydrodynamic storm surge, waves, and sediment transport modeling. He has provided technical expertise for FEMA flood hazard risk analysis for riverine and coastal studies for many miles of riverine and coastal shoreline. He has experience in stormwater management analysis and design, and in NPDES, TMDL, and MS4 requirements, and watershed studies utilizing GIS applications. He has thorough knowledge of near-shore coastal processes including refraction/diffraction analysis, run-up, littoral transport, coastal structures, and beach erosion. He has served on a variety of water resources projects in transportation, water supply, bridge hydraulics and scour analysis, and sewer system design and construction.

Dr. Mahmoudpour provided technical assistance on wave damage functions of the USACE Coastal Storm Damage Prevented Research and Development project, and was a lead engineer for the *Limit of Moderate Wave Action Operating Guidance* and *Primary Frontal Dune Best Practices* documents prepared for FEMA. He has co-presented at the Ocean Studies Board meeting on the topic: "Developing a Coastal Impact Factor to Assess Hurricane Intensity, for Ocean Studies Board," Board on Atmospheric Sciences and Climate, National Research Council, NAS, March 2013.

Dr. Mahmoudpour has extensive experience in stormwater management, erosion sediment control, and Best Management Practices design for linear and land development projects. He has provided the technical lead for hydrologic and hydraulic and scour analysis utilizing HEC-18, USACE publications, for the full design, demolition, and replacement of the Fort Benning and PennDOT bridges.

Dr. Mahmoudpour performed flood hazard risk analysis and prepared flood insurance studies for Hillsborough County, Lee County, Monroe County, and Flagler County, Florida. He oversaw and supervised two-dimensional storm surge and wave modeling; coastal near-shore processes and analysis; coastal flood hazard statistical analysis, performing event- and response-based approaches; overland wave propagation modeling utilizing Wave Height Analysis for Flood Insurance Studies, CHAMP, and Runup (utilizing the cross-shore numerical model for waves, currents, sediment transport); and beach profile evaluation for Great Lakes studies. He supervised the flood hazard risk mapping effort for the entire shorelines of the states of Connecticut, Massachusetts, and Maine, and for Clatsop (Oregon) and Thurston (Washington) counties.

He provided technical services for sediment transportation utilizing Soulsby's equation for Currents and Sediment Dynamics Studies for the Raritan Bay Slag Superfund Site, provided technical services for coastal structure of the Hurricane Barrier Walkway Design (USACE New Bedford, Massachusetts), and provided quality review for Rondout Reservoir (New York) Spillway Siphon Design, Environmental Loads, such as wave forces in conceptual design.

Dr. Mahmoudpour has overseas experience as a hydraulic engineer conducting the review of a pre-feasibility study of a water supply project from Iran to the United Arab Emirates, prepared by the La-Mayer consultancy in which he investigated and reanalyzed water hammer issues for the project. He served as design engineer and marine installation manager to design and install a 10-mile sub-sea pipeline from Bandar-Abass to Hormuz Island in the Persian Gulf, Iran.

A.5 Mr. Jesse McDonald

Role: Plan Formulation/Economics

Mr. McDonald holds an MS degree in Agricultural Economics from Mississippi State, and an MS degree in Water Resource and Urban Planning from Georgia Institute of Technology, and has over 50 years of experience in economic analysis and plan formulation.

Mr. McDonald began his career with the USACE as an economist where he conducted analyses, and prepared economic base studies and evaluations of existing and proposed civil works projects. During this time, he served as a project manager of the public involvement program for the Pine Bluff, Arkansas, Urban Study and the Mississippi River Backwater Pump Study. His analyses included evaluations for flood control, water supply, recreation, and small harbor projects. He also served on the Inland Navigation System Prioritization Task Force, and as Assistant Chief of Branch for the Vicksburg District and Lower Mississippi Valley Division.

During the later years of his career with USACE, Mr. McDonald served as Supervisory Regional Economist where he was responsible for all economic and social aspects of the Mississippi River Commission/Mississippi Valley Division water resource planning functions. He served as a member of the task force reengineering the Lock Performance Monitoring System and served as project manager of studies involving 1993 Mid-West Flood and Mississippi River Impacts of Missouri River Reservoir Operations, including impacts on inland navigation.

Since his retirement from USACE in 2000, Mr. McDonald has acted as a private consultant providing economic analysis services in support of numerous water resource projects. These services include cost allocation, financial analyses, and the analysis of environmental preservation and restoration projects.

As a consultant, he has provided services to numerous USACE Districts. Specifically, he supported the efforts of the Memphis District, providing hydrologic engineering, plan formulation, and economic analysis of a Section 205, Small Flood Control Project in Forrest City, Arkansas; the efforts in the urban area of Memphis/Shelby County, Tennessee; and an effort in Lilbourn, Missouri. While acting in his capacity as a contractor to the New Orleans District, he conducted economic analyses in support of a Flood Control Study of Morganza to the Gulf, Louisiana, as well as the saltwater marshland in south Louisiana for Phase I of the Louisiana Coastal Area Ecosystem Restoration Feasibility Study. He also collaborated with another firm supporting the New Orleans District to conduct a preliminary analysis of the economic, environmental, and engineering feasibility of deepening the Ports of Iberia and Morgan City, Louisiana, and prepared preliminary Plans of Study for the analysis of each port under the authority of Section 203 of WRDA 1986.

Mr. McDonald was involved in various data collection efforts concerning the Donaldsonville to the Gulf Study in south Louisiana, the Reconnaissance Study for Mustang Bayou near Alvin, Texas, and the

Dredged Material Management Plan for Chocolate Bayou. He later collaborated with various firms in support of the Louisiana Department of Natural Resources' development of a Comprehensive Master Plan for Hurricane Protection and Coastal Restoration.

In addition to providing years of consulting services to USACE, Mr. McDonald has participated in a previous IEPR for the Alabama-Coosa-Tallapoosa River Basin Water Control Manual Update and EIS. In support of this effort, he was responsible for the socio-economic impacts of the existing operating plan and operating alternatives considered in the study. Specifically, the EIS considered impacts on flood risk management, navigation, recreation, water supply, and on fisheries and the benthic community.

A.6 Dr. Bolyvong Tanovan

Role: Civil/Design Engineering

As a river operations manager and planner, Dr. Tanovan has 25 years of experience in planning and managing the operations of the Columbia River multi-project river system for flood control, hydropower, water supply, water quality, recreation, navigation, and fish and wildlife. He worked in senior planning or engineering roles as USACE, Northwestern Division Water Quality Section Chief, from 1983–1999, and Power Branch Chief, from 1999–2008. As Chief of Water Management Power Branch, he led annual operational planning for the 31 major Corps and other Treaty dams on the Columbia River System. In this capacity, he maintained regional coordination with federal and nonfederal project owners and operators in the Pacific Northwest, and managed the Hydropower Analysis Center of Expertise tasked with performing hydropower studies for Corps projects across the nation, and for hydro projects in several foreign countries. He coordinated activities with other federal agencies, state river basin authorities, regional planning commissions, and hydropower utilities involved in the large, complex civil works projects in the Columbia River basin. This position had high public, interagency, and regional/international interest, being challenged under the Endangered Species Act, the Clean Water Act, the Columbia River Treaty with Canada, and the Pacific Northwest Coordination Agreement for hydropower generation. Dr. Tanovan was actively involved in planning and actual daily reservoir system operations in the Columbia River Reservoir Control Center and Interagency Technical Management Team to meet water quality standards and the mainstem fish passage survival goal while optimizing system hydropower generation. As Chief of the Fish and Water Quality Section (1983–1999), Dr. Tanovan supervised planning and operation of environmental projects for the USACE Northwestern Division, and served as a member of the USACE National Water Quality Committee.

In the capacity of water resources engineer, Dr. Tanovan is experienced in building and using rules-based reservoir simulation models such as HEC-ResSim (and HEC-5) to analyze alternatives for operation of Columbia River multi-project and multipurpose river systems. Dr. Tanovan was deeply involved in hydropower, anadromous fish passage, and water quality operations and analyses, using HEC-5Q and other water quality models (e.g., CE-QUAL-R1 and R2) to analyze water quality interactions in both lake (e.g., Grand Coulee, Dworshak, and Libby) and river systems (Columbia-Snake Rivers). He has 25 years of demonstrated experience in system operational planning and managing the water quality and fish passage program for the large, complex Columbia River system civil works projects with high public and interagency interest. Dr. Tanovan performed as tri-agency Water Quality Work Group Leader in the multi-million dollar Columbia River System's Operation Review; and was Technical Lead in the initial phase of the Columbia Treaty Review.

Prior to USACE, Dr. Tanovan worked on basin and land-use planning; flood insurance studies for FEMA; and watershed and dam-break modeling for Oregon counties. He also developed a basin-wide SSARR-based [Streamflow Synthesis and Reservoir Regulation] Upper Mekong flood forecast model, and a SOGREAH-based [Société Grenobloise dEtudes et dApplications Hydrauliques] Mekong Delta model, and he prepared long-term indicative hydropower basin development plans. Dr. Tanovan holds an MS in Civil Engineering and PhD. in Hydrologic Engineering, Federal Institute of Technology, Lausanne, Switzerland, and has been a licensed/registered PE since 1977.

Appendix B Charge Questions

At the beginning of the review process, the OEO provided charge questions to the Panel. The Panel used these charge questions to guide its review. Working with the Panel, the OEO ensured that all charge questions were appropriately addressed. Below are the charge questions that were provided to the Panel.

NEW JERSEY BENEFICIAL USE OF DREDGED MATERIAL
FOR THE DELAWARE RIVER FEASIBILITY STUDY
INDEPENDENT EXTERNAL PEER REVIEW
CHARGE TO REVIEWERS

The following Charge to Reviewers outlines the objective of the Independent External Peer Review (IEPR) for the subject study and the specific advice sought from the IEPR panel.

The objective of the IEPR is to obtain an independent evaluation of whether the interpretations of analysis and conclusions based on analysis are reasonable for the subject study. The IEPR panel is requested to offer a broad evaluation of the overall study decision document in addition to addressing the specific technical and scientific questions included in the charge. The panel has the flexibility to bring important issues to the attention of decision makers, including positive feedback or issues outside those specific areas outlined in the charge.

The panel review is to focus on scientific and technical matters, leaving policy determinations for USACE and the Army. The panel should not make recommendations on whether a particular alternative should be implemented or present findings that become "directives" in that they call for modifications or additional studies or suggest new conclusions and recommendations. In such circumstances the panel may have assumed the role of advisors as well as reviewers, thus introducing bias and potential conflict in their ability to provide objective review.

Panel review comments are to be structured to fully communicate the panel's intent by including the comment, why it is important, any potential consequences of failure to address, and suggestions on how to address the comment. The IEPR Performance Work Statement provides additional details on how comments should be structured.

<u>Broad Evaluation Charge Questions</u>

1. Is the need for and intent of the decision document clearly stated?
2. Does the decision document adequately address the stated need and intent relative to scientific and technical information?

Given the need for and intent of the decision document, assess the adequacy and acceptability of the following:

3. Project evaluation data used in the study analyses,

4. Economic, environmental, and engineering assumptions that underlie the study analyses ,
5. Economic, environmental, and engineering methodologies, analyses, and projections,
6. Models used in the evaluation of existing and future without-project conditions and of economic or environmental impacts of alternatives,
7. Methods for integrating risk and uncertainty,
8. Formulation of alternative plans and the range of alternative plans considered,
9. Quality and quantity of the surveys, investigations, and engineering sufficient for conceptual design of alternative plans, and
10. Overall assessment of significant environmental impacts and any biological analyses.

Further,

11. Evaluate whether the interpretations of analysis and the conclusions based on analysis are reasonable, and
12. Assess the considered and tentatively selected alternatives from the perspective of systems, including systemic aspects being considered from a temporal perspective, including the potential effects of climate change.

For the tentatively selected plan, assess whether:

13. The models used to assess life safety hazards are appropriate,
14. The assumptions made for the life safety hazards are appropriate,
15. The quality and quantity of the surveys, investigations, and engineering are sufficient for a concept design considering the life safety hazards and to support the models and assumptions made for determining the hazards, and
16. The analysis adequately addresses the uncertainty and residual risk given the consequences associated with the potential for loss of life for this type of project.

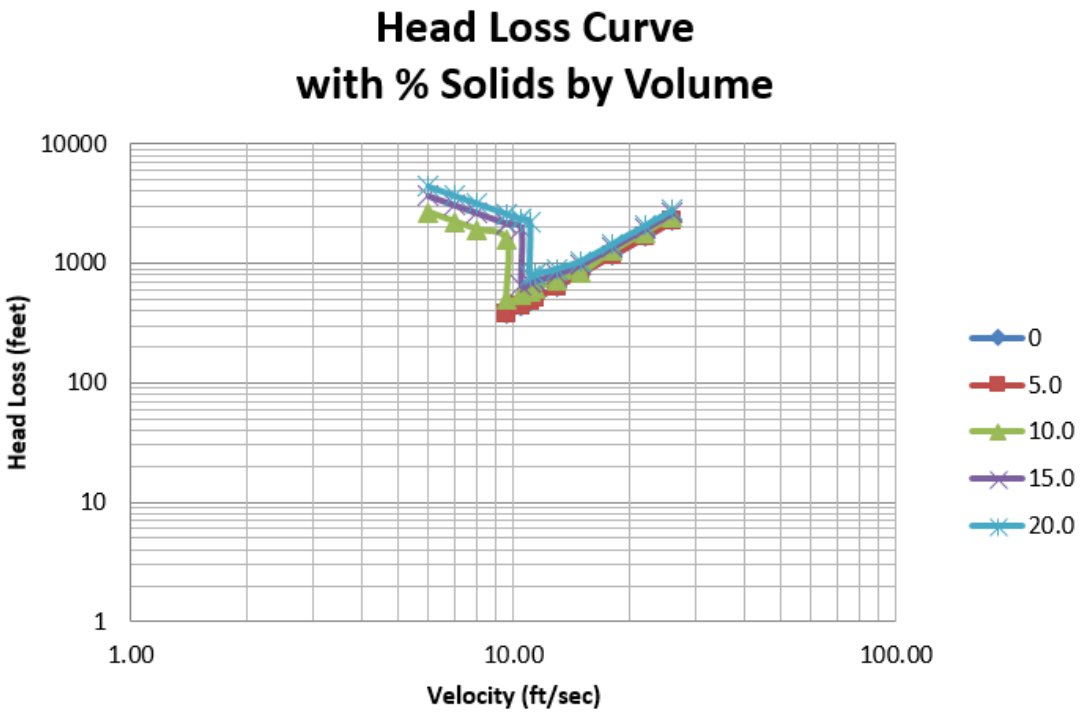
Appendix C Calculation of Head Loss for New Jersey Beneficial Use of Dredged Material Dredge Pipeline (In Support of Panel Comment 1)

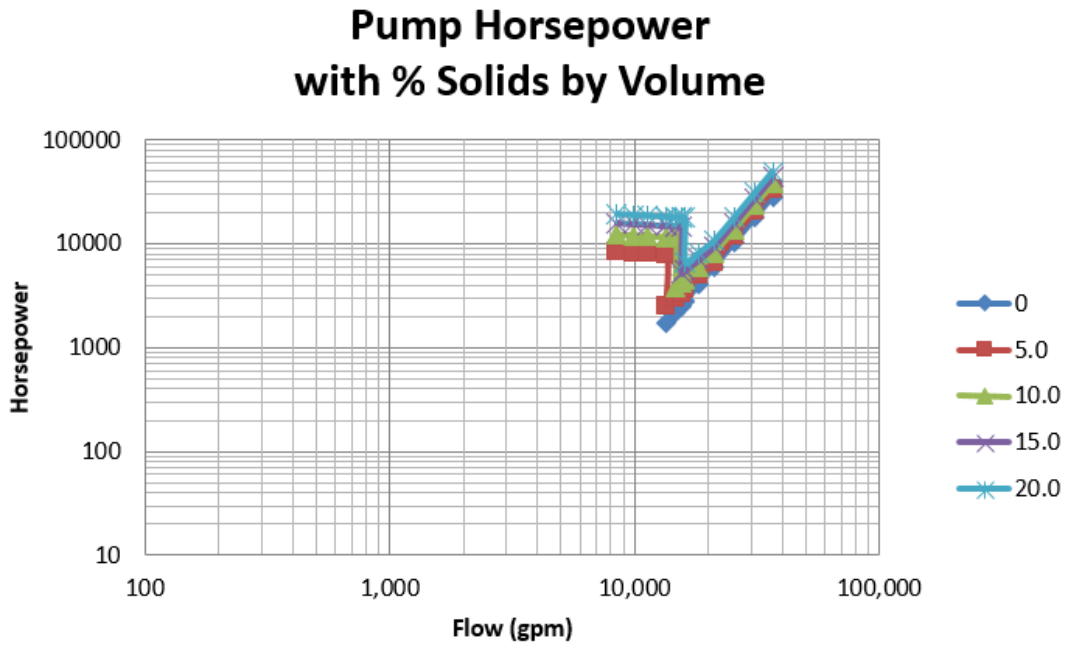
Calculation of Head Loss NJ BUDM Dredge Pipeline								
g =	32.2	ft/sec^2	D =	2	ft			
Area =	3.14	ft^2	Temp =	50	F	Visc =	1.42E-05	ft^2/sec
SG_s =	2.65		L =	42000	ft			
	1.60		d_{50} =	0.2	mm			
d_{50} =	0.00066	feet	K(tot) =	10				
V_{ss} =	0.051	ft/sec		FL =	0.669	0.730	0.768	0.796
V_h =	18.06	ft/sec		V_c =	9.60	10.47	11.01	11.41
eff =	0.75		SG_m =	1.02	1.102	1.183	1.265	1.346
Hs=	20	ft	C =	0	5.0	10.0	15.0	20.0

V, ft/sec	N_r	f	L_e (ft)	h_f (ft)	h_f (ft)	h_f (ft)	h_f (ft)	h_f (ft)
6.00	8.45E+05	0.0123	43631		2660.2	3659.4	4411.1	5036.8
7.00	9.85E+05	0.0120	43672		2234.1	3072.1	3702.5	4227.2
8.00	1.13E+06	0.0117	43708		1921.1	2640.6	3181.9	3632.4
9.60	1.35E+06	0.0114	43758		1564.2	2148.6	2588.2	2954.2
9.60	1.35E+06	0.0114	43758	376.1	498.3	2148.6	2588.2	2954.2
10.47	1.47E+06	0.0112	43783	437.9	547.6	1948.2	2346.4	2677.9
10.47	1.47E+06	0.0112	43783	437.9	547.6	657.4	2346.4	2677.9
11.01	1.55E+06	0.0111	43797	478.9	582.0	685.1	2215.7	2528.6
11.01	1.55E+06	0.0111	43797	478.9	582.0	685.1	788.2	2528.6
11.41	1.61E+06	0.0111	43807	510.4	609.0	707.7	806.4	2427.7
11.41	1.61E+06	0.0111	43807	510.4	609.0	707.7	806.4	905.0
13.00	1.83E+06	0.0108	43845	643.6	727.8	812.0	896.2	980.4
15.00	2.11E+06	0.0106	43888	832.3	832.3	974.1	1045.0	1115.9
18.06	2.54E+06	0.0103	43944	1164.6	1257.6	1350.7	1443.7	1536.8
22.00	3.10E+06	0.0100	44006	1669.0	1802.3	1935.7	2069.0	2202.4
26.00	3.66E+06	0.0097	44059	2265.8	2446.9	2627.9	2809.0	2990.0

V, ft/sec	Q (ft^3/sec)	Q (gpm)		HP	HP	HP	HP	HP
6.00	18.85	8,460			8355	12344	15905	19331
7.00	21.99	9,870			8187	12090	15575	18928
8.00	25.13	11,280			8045	11876	15297	18588
9.60	30.16	13,534			7859	11595	14929	18139
9.60	30.16	13,534		1750	2504	11595	14929	18139
10.47	32.88	14,759		2222	3001	11465	14760	17931
10.47	32.88	14,759		2222	3001	3869	14760	17931
11.01	34.59	15,526		2556	3355	4241	14662	17811
11.01	34.59	15,526		2556	3355	4241	5216	17811
11.41	35.86	16,094		2824	3639	4542	5531	17726
11.41	35.86	16,094		2824	3639	4542	5531	6608
13.00	40.84	18,329		4055	4953	5935	7001	8153
15.00	47.12	21,149		6052	6535	8215	9420	10707
18.06	56.73	25,460		10194	11888	13712	15667	17751
22.00	69.12	31,019		17798	20756	23941	27354	30994
26.00	81.68	36,659		28557	33303	38413	43888	49728

This spreadsheet calculates the head loss and horsepower requirements for pumping a slurry mixture. The parameters shown in the highlighted boxes may be changed. All other boxes are locked to prevent changes. The parameters are:	
D	Diameter of the pipe
Temp	Temperature of the slurry
L	Length of the pipe
d_{50}	Median grain size of the solid in the slurry
K	Minor head loss factors for valves, bends, and other obstructions
SG_s	Specific gravity of the solids
SG_m	Combined specific gravity of the slurry (you may change only the first block which is the specific gravity of the liquid)
C	Solids content as a percent of volume
eff	Pump efficiency
Hs	Gravity head


Head Loss Curve
with % Solids by Volume
10000
1000
100
10
1
Head Loss (feet)
1.00
10.00
100.00
Velocity (ft/sec)
0
5.0
10.0
15.0
20.0


Pump Horsepower
with % Solids by Volume
100000
10000
1000
100
10
Horsepower
100
1,000
10,000
100,000
Flow (gpm)
0
5.0
10.0
15.0
20.0

Assumptions inherent in the calculation:	
(1) The head loss in the pipe is based on a smooth pipe. This is acceptable for a steel pipe in use or a HDPE pipe, but may underestimate the head loss in a rusty steel pipe.	
(2) The equation for terminal velocity is applicable for d_{50} in the range of 4mm to 0.06mm.	
(3) The equation for calculating Reynolds number is valid for the range of 40E+3 to 60E+6.	
Other Parameters:	
V_{ss}	The terminal velocity at which sand sized quartz particles settle out in flowing water.
V_c	The critical velocity at which flow transitions from flow with a stationary bed to heterogeneous flow.
V_h	The velocity at which flow transitions from heterogeneous flow to pseudohomogeneous flow.
Visc	The kinematic viscosity of water (depends on the temperature and the mass of the fluid. It is not based on the mass of the slurry, therefore head loss may be underestimated for slurry's with very high solids content).
N_r	The Reynolds number (velocity times diameter divided by kinematic viscosity).
f	The friction loss factor for the Darcy-Weisbach equation for head loss (used to calculate the head loss for the column with fluid only).
L_e	The equivalent length of pipe equal to the length plus K times diameter divided by f.
FL	An intermediate step in the calculation of critical velocity.

Comments on using this Calculation:

The calculation compares the flow with fluid only to four different slurry concentrations. At velocities greater than V_h the head loss and horsepower requirements are similar. At velocities below Vc the slurry will segregate and flow as two distinct phases. The proper operating range is between Vc and Vh. The pipe size is adjusted by iteration to obtain the required flow in the correct velocity range.

Acronyms

Acronym	Definition
APMI	Analysis Planning and Management Institute
BFE	Base Flood Elevation
BS	Bachelor of Science
CDF	Confined Disposal Facility
CEI	Continuing Eligibility Inspections
COI	Conflict of Interest
CSRM	Coastal Storm Risk Management
DOE	Department of Energy
EA	Environmental Assessment
EC	Engineering Circular
EIS	Environment Impact Statement
EL	Elevation Level
ER	Engineering Regulation
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Maps
FIS	Flood Insurance Study
FONSI	Finding of no Significant Impacts
GIS	Geographic Information System
GDS	Grid Developer System
GSA	General Services Administration
HEC	Hydraulic Engineering Center
HEC-RAS	Hydraulic Engineering Center's River Analysis System
IEPR	Independent External Peer Review
LMI	Logistics and Management Institute
MS	Master of Science
MS4	Municipal Separate Storm Sewer System
MSL	Mean Sea Level
NACCS	North Atlantic Coast Comprehensive Study: Resilient Adaptation to Increasing Risk
NAS	National Academy of Sciences
NAVD 88	North American Vertical Datum of 1988
NED	National Economic Development
NEPA	National Environmental Policy Act
NJ BUDM FS/EA	New Jersey Beneficial Use of Dredged Material for the Delaware River Feasibility Study and Integrated Environmental Assessment
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
OEO	Outside Eligible Organization
PE	Professional Engineer
PhD	Doctor of Philosophy
SLC	Sea-level Change
TMDL	Total Maximum Daily Load

Acronym	Definition
TSP	Tentatively Selected Plan
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USEPA	U.S. Environmental Protection Agency
WRDA	Water Resources Development Act
WSE	Water Surface Elevation